SUPPLEMENT.

The Mining Journal,

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FORMING A COMPLETE RECORD OF THE PROCEEDINGS OF ALL PUBLIC COMPANIES.

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Original Correspondence.

THE NEWPORT ROLLING-MILLS, MIDDLESBOROUGH.

These works have been seven years in operation. The proprietors, Messrs. Fox, Head, and Co., have confined their operations mainly to finished iron, the pig-iron used being supplied by the various smelting firms in the Cleveland district.

Messrs. Fox, Head, and Co.'s Newport works comprise a forge containing 40 puddling-furnaces and other appliances; and closely adjoining these two mills for the manufacture of ship, boiler, and girder plates. The works at first were not of their present extent, but have been enlarged at different times. The forge engine has one 28-in. horizontal cylinder, 4 ft. stroke, the diameter of the fly-wheel being 22 ft., and its weight 32 tons. Two pairs of 22-in. rolls are driven by this engine, on the reversing principle, by means of a clutch, which is worked by a small steam-engine. Five spur-wheels intervene, to give the alternating motion to the rolls. The engine is driven at the rate of 40 revolutions per minute, the speed of the rolls being then about 25 revolutions. The puddled bars rolled here are principally of large size for plates, up to 14 in. by 1 in. These bars are cut into proper lengths to form piles by a pair of large shears, driven by an engine with 15-in. vertical cylinder. The puddled balls are manipulated by two 3-tons double-acting steam-hammers, of the kind known as Morrison's hammers, but with some important improvements introduced by Messrs. Fox, Head, and Co.

Of the 40 puddling-furnaces, 25 are on the patent principle with which this firm has long been identified; seven are connected with stack boilers, and nine are ordinary plain furnaces. The patent furnaces afford remarkably good results in economy of fuel, the consumption of coal with them averaging from 15 to 16 cwts. per ton of puddle bar, and in one furnace, built with certain more recent improvements, 12 to 13 cwts. of coal only is required. The ordinary puddling-furnaces consume about 24 cwts. of coal per puddle bar.

The principle of action of these patent furnaces is the heating of the air for the combustion of the fuel to a high temperature. By means of a steam-jet blowing into a funnel, the air is made to pass up and down a partitioned stove-pipe, which is placed in a chamber attached to the chimney, and heated externally by the waste heat from the furnace. The air mixed with steam, and heated in the stove-pipe, as described, is delivered partly into the closed ash-pit below the grate, and partly in jets above the burning fuel, resulting in the economy above mentioned, and a great reduction of the amount of smoke emitted. Four of the puddling-furnaces heat two double-flued stack boilers. The shell of each boiler is 22 ft. by 6½ ft.; the vertical flues are 2½ ft. in diameter, each vertical flue having 13 tapered cross-tubes welded in. Three other furnaces heat three separate stack boilers, each 22 ft. by 5 ft., with one vertical flue, 2½ ft. in diameter. Each flue has eight cross-tubes welded to it. The pressure of steam is about 50 lbs. throughout the whole of the boilers.

Under the same roof as the forge a 16-in. billet mill is placed, consisting of one pair of rolls, driven direct by an engine of 24-in. horizontal cylinder, 3-ft. stroke, at the rate of 90 revolutions per minute. The fly-wheel on this is 8 tons weight. The billets are rolled about 1¼ inch square, and are utilised for the manufacture of wire at a neighbouring wireworks.

The plate-mills, engine, and other appliances in connection with them are placed under a spacious roof. The mill engine has one 34-in. horizontal cylinder, 4-ft. stroke. The fly-wheel is 25 ft. in diameter, and weighs 42 tons. The engine makes 40 revolutions per minute; it drives on one side a pair of blooming rolls, and two pairs of 22-in. plate rolls; these are for the heavier plates up to 1 in. in thickness. On the other side are driven two pairs of 22-in. rolls for thinner plates. The former is a reversing mill, worked by a clutch and long lever; the alternating direction of motion is obtained, as in the forge, by the intervention of five spur-wheels. The speed of these rolls is about 25 revolutions per minute. There are two plate shears placed in suitable positions, each is driven independently by a 15-in. vertical cylinder. The blades are 6 ft. in length, and will cut plates up to 1¼ in. in thickness. A pair of cropping shears for scrap iron form a part of each machine.

Eleven mill furnaces are erected; eight of these have separate stack boilers attached. The shell of each boiler is 27 by 5½ ft., one vertical flue to each 3 ft. diameter; each flue has 12 tapered cross tubes welded in. There are in use besides the above three plain cylindrical boilers, fired by hand, each 45 by 4 ft.; they are all hung upon volute springs, to allow of free expansion and contraction, a plan that has been found to prevent the tendency to rupture to which long boilers are peculiarly liable. This system was fully explained in a paper read before the Iron and Steel Institute, and which appeared in the Quarterly Journal for January last.

There are three steam-pumps for feeding boilers; one of these with 6-in. inverted cylinder is placed near the forge engine, and also a feed heater. Two others in a building covered by an iron tank have each an 8-in. horizontal cylinder. The feed water is supplied from the Stockton and Darlington Water Works, and is heated nearly to the boiling point by exhaust steam. Another larger horizontal engine in the same building pumps river water to the tank to supply the puddlers' boshes, &c.

There is an engine for working a Blake's crusher, and an ore mill; these are used for breaking and grinding mill cinder. Another engine turns the roll-lathe, which is 15 feet in bed, 18 inch centre. An engine is used to drive the fan for smiths' fires, one drilling-machine, and a grindstone. In all there are 14 engines, acting independently of one another. The whole of the boilers and steam-pipes are coated with non-conducting composition, of which Messrs. Fox, Head, and Co. are the patentees and manufacturers. After the composition is laid on it is cased with wire netting and hoop iron straps, and then served over with a mixture of tar and pitch. This gives a very neat finish, and is apparently very durable. Messrs. Fox, Head, and Co. carry on a subsidiary manufacture of this commodity, amounting to about 700 tons annually.

The System of Co-operation.—The number of persons employed in the Newport Rolling-Mills is about 530. One noteworthy feature in connection with them is the co-operative scheme introduced by this firm in the year 1866, which has continued in force to the present time. It has been productive of good results in promoting a state of mutual confidence between employers and workmen. Since the system came into operation no stoppage of the works has taken place from strikes, whereas before strikes were frequent, being as detrimental to the interests of the workmen themselves as to those of the proprietors. It is now the interest of the former to keep the works going profitably, since they participate in the profits of the concern whenever these exceed a certain percentage set aside as interest on the capital embarked by Messrs. Fox, Head, and Co. The co-operation scheme has been adopted at these works with the view of avoiding disputes between employers and employed, which it is believed often arise from a mistaken estimate on the part of the workmen of the profits that are made by capitalists. The principles of the scheme are that every agent and workmen should have a pecuniary interest in the success of the concern, and the profit to be made, according to the amount of his earnings. That the remuneration of the employed shall be at the customary rates paid in the district. That the capital expended shall be remunerated by a specified rate of interest. That the works and plant shall be kept in a perfect state of repair, and to cover their depreciation and renewals a certain allowance shall be made from the revenue. That a fund shall be provided for any loss by bad debts. These provisions being satisfied the clear profit shall at the end of each year be ascertained, and divided into two equal parts, one-half being paid to the capitalists, the other half to the employed, in proportion to the wages earned.

There are other rules and conditions by which all engaged at the works are bound, as that Messrs. Fox, Head, and Co., being the sole owners and solely taking the risk, should also retain the entire control of the business. Neither the firm nor any person employed may belong to any Trades Union. A general rise or fall of wages takes effect as soon as the alteration has been accepted by the iron trade of the district. The rate of interest paid on capital is 10 per cent. A public accountant audits the accounts every year, who declares the surplus, if any, and the bonus to be paid, and decides all matters in dispute as to the interpretation of the written co-operative scheme.

Such is an outline of the method adopted primarily with the view of avoiding trade disputes and difficulties. The subject has excited great attention of late years, and the principle of industrial partnerships will it is thought come to play an important part in the well-being and peace of the workmen of this country, and afford similar advantages to the employers of labour.

The amount to which Messrs. Fox, Head, and Co.'s workmen became entitled at the end of the year 1870 was 1600*l.*, being at the average rate of 3*l.* for each person employed. In order to discourage wandering habits only those who have worked 100 days and upwards in the works are entitled to share in the profits.

THE ASHTON VALE IRONWORKS AND COLLIERIES.

There is scarcely any county in England where the mineral productions are of such a varied character as those found in Somersetshire. Amongst them are coal, ironstone, lead, copper in the state of sulphuret, calamite, manganese, malachite, &c. At present, however, there is only one establishment in the county where iron is made and forged. About three miles from Bristol, situate in a most picturesque spot, having on one side the Clifton Suspension Bridge, with the handsome range of buildings on the adjoining heights, and on the other some charming pastoral scenery and "flowery meads," are the ironworks and collieries of the Ashton Vale Company. They were laid out a few years since, by Mr. E. Knight, of Weston-super-Mare, an engineer of considerable experience, and well acquainted with the minerals of the district, and who is now one of the largest shareholders in the company. The mills were let a short time since to Mr. Tinn, of Newcastle, who has made considerable alterations, amongst others having brought the bar and sheet mills, which were some distance from each other, under the same shed. So great, however, is the demand for the material made that another mill is about to be put down. There are two sheet mills on what is termed the sheet side, driven by a pair of engines of 90-horse power, 32-inch cylinders, with 4-feet stroke, rolling the plates 22 inches in diameter. The power is obtained by means of five boilers, one egg-shaped, the other four being of the ordinary Cornish type. There are two heating, two balling, and two annealing furnaces. In connection with the mills are a cutting machine and a scaling furnace, and all the other appliances required in rolling. The pig used includes that made by the Ashton Vale Company and the Cleveland, and for the better class of sheets the Barrow hematite. A good deal of what is produced at the mills is sent to Bristol.

On the forge side is the bar mill, which is driven by an engine of 50-horse power. There are seven puddling furnaces at work, and three ball furnaces. The boilers, five in number, are upright egg-shaped, and there is a steam-hammer 18 to 20 tons. The coal used comes from Kingswood and the neighbourhood, and also from South Wales by water, there being a line of rails laid down from the works to the river Avon. The Bristol Railway runs quite close to the mills, so that there is every facility for sending the manufactured iron away, and receiving the pig, coal, &c.

The Ashton Vale Company have one large iron-cased furnace in blast, open-topped, but preparations are being made to have it so altered that the gases can be taken off and utilised for heating the boilers and stoves, and for that purpose the stack has been raised 40 feet, so that it is now 130 feet high. The furnace itself is 60 feet in height, and is worked with five tuyeres. The engine is of 60-horse power, with five egg-boilers, 40 feet long. For raising the stone and the material required for smelting there is a large hydraulic lift. The native ore, got just above the coal, is only a thin seam, and is of an argillaceous character. The quantity raised is not more than 2000 tons a year. A good deal of the stone used comes from Northamptonshire—principally from Butlin and Co., of Wellingborough—the produce of the furnace being about 140 tons of pig a week.

The collieries belonging to the company are extensive, the one now at work being situate quite close to the blast-furnace, whilst there is another one about a mile distant. Of the Bedminster seam there is an area of about 1000 acres, and upwards of 2000 acres of the Ashton steam, coking, and house coal. The unworked coal area is the largest in the Bristol coal field. The colliery at Ashton is 226 yards deep, the drawing and upcast shafts being 11 ft. in diameter. The ventilation is procured by means of a fan 8 ft. high, and 11 ft. in diameter. There are two seams of coal, locally termed the top vein and the great vein, the former being about 3 ft. in thickness, whilst the other varies a good deal, in some places being from 3 to 4 ft., and in others being 8 ft. and upwards. The machinery employed consists of a pair of 60-horse power winding-engines, 27-in. cylinders, with three ordinary boilers, 40 ft. long. The cage is a single-decked one, drawing two tubs at a time. Little or no gas is made in the pit, so that accidents of a fatal character are of rare occurrence. A great deal of water, however, is made, and is at present got out by means of iron tanks, but another mode will shortly be adopted. Tanks are about to be put at the bottom of the corfs, so that at every draw of coal a quantity of water will be brought out at the same time. At the old pit, which was formerly a drawing shaft, there is an engine by which the coal is drawn to the level of the new shaft. There is a washing machine for cleaning the slack, which is used for converting into coke. The output of coal is about 1400 tons per week. In connection with the colliery there are 50 coke ovens, producing about 200 tons of coke weekly.

At the South Liberty Colliery the men are engaged in sinking from the seam that has been worked to the bottom bed, and the coal is expected to be found at a depth of about 480 yards. The depth now reached is rather more than 400 yards, so that no considerable time will elapse before the coal is won. In sinking the men a month or two since cut through an excellent seam of coking coal, locally known as the Toad vein, and nearly 7 ft. in thickness, which, no doubt, will be worked at some future time. When the coal is reached at the South Liberty pit the Ashton Vale Company will be in a position to raise upwards of 3000 tons weekly, and there will not be much difficulty in finding markets for it, Bristol itself, from the number of works, and the large quantity of coal required for marine, locomotives, and stationary engines, being a large consumer, the Bedminster great vein, and the others in the same coal field, being favourites in the city, as well as in the district. In addition to the colliery being quite close to the railway, there is a tramway to the River Avon, running through Bristol, and on its banks there are some very extensive works. The progress made by the company now is such as to ensure to the shareholders a fair return for the capital invested, and it may lead to other works being established, seeing that there are large quantities of stone in the county, more especially on the Brendon and Eisen Hills, whilst at Frampton Cottrell, a few miles from Bristol, a much larger tonnage of fine hematite would be raised than there has been hitherto.

SOUTH YORKSHIRE COLLIERIES.

MESSRS. NEWTON, CHAMBERS, AND CO.'S THORNCLIFFE COLLIERIES.

Founded about the year 1794, then comparatively a very small concern, these collieries have, principally through the energy and perseverance of the late partners, gradually assumed the importance and prominence which now characterise them. Till within the last six or seven years the improvement was progressive, and every prospect was bright and prosperous. Then began a series of struggles on the part of the workmen, disagreements between employers and employed, now happily ended, and it is hoped never to be renewed, which after an eight months' stand in the beginning of 1867 culminated in what is known in the neighbourhood as "the great strike," which began on March 24, 1869, and terminated in the latter part of August, 1870. The riots, the threatening letters, the constant alarms, the calling out of the military for some months, the 30 newly-built houses smashed in and gutted, the trials at York, &c., will all be yet fresh in the memory of your readers. Happily a better understanding now exists, and everything points to a period of peace after conflict, all the more lasting and all the better appreciated on account of the fighting and unrest which preceded. But it is not our intention to describe the riots, but the collieries as they now stand.

The coal field taken by Messrs. Newton, Chambers, and Co., in 1794, and subsequently added to by various other leases, is situate seven miles north from the town of Sheffield, eight miles from Barnsley, and ½ mile from the Chapeltown station on the South Yorkshire Railway, and lies to the westward of a large upthrow fault of 40 yards, the direction of which is north 30 west, and its position where nearest the ironworks is 1450 yards north 60 east from them. The line of water level is very nearly parallel with the main fault. The dip is towards the fault about 1 in 12 or 14.

The principal throws besides the main one are four in number, and if we follow the levels in the Silkstone coal we get a very accurate idea of their position. The Tankersley pit is about 1¼ mile from the ironworks, and about 1000 yards north 60 east from the main fault. The levels to go the north boundary about 800 yards. Direction north 7 to 15 west; 400 yards from the pit they meet with a large role, in which the coal thickens considerably, and which turns the levels nearly dip bord for some distance. From Tankersley pit, coming south along the level, the first throw we meet with is 726 yards from the shaft. It is a downthrow to the south. Its direction is north 78½ east, and its size where crossed in the levels 8 yards. Towards the rise it splits into several smaller throws. It is not yet proved on the dip. Still continuing on the level 286 yards further we come to an upthrow to the south of 12 yards, the direction of which is nearly parallel with the last-named north 80 east. Towards the rise bord the throw remains the same, and in it the furnace for ventilation is constructed, which we shall afterwards notice: 22 yards further along the level to the south and we come to the pumping-shaft, which clears the whole of the Silkstone seam of water. Travelling still into the south, and crossing a small throw till we get 792 yards from the pumping-shaft, we come to the third main throw, which is here 7 yards up to the south, but which on the rise bord, where proved before, was 14 yards. The direction is north 54 west. Still pursuing our journey along the levels for 352 yards, but finding a material alteration in the height of the seam, which we will afterwards explain, we find ourselves at the bottom of the second shaft drawing Silkstone coal—the Norfolk pit, so called because on the Duke of Norfolk's property. Having rested awhile, for the journey has been a long one, we resume our tramp to find throw No. 4. After travelling 890 yards, and passing one or two small throws, we come to the face of the levels, and the men tell us that they have just found the throw. We examine the place, and the throw is there; but what size it may be there is no accurate information to prove. It is 30 or 40 years since the former pits were worked, and traditions as to its size are various—from 10 to 30 yards. The direction will be about north 70 east. Looking over our memoranda to see the distance from one end of the level to the other we find it to be 3868 yards, or nearly 2¼ miles.

We now pass on to notice the different seams of coal and ironstone

which are workable in the coal field above named. To contrast the thickness and depth of the different seams on the bassit and dip we cannot do better than quote the records of some sinkings in 1810 and 1821, and then the result as found at Tankersley pit, which goes through the whole of the workable seams.

PIT SUNK NEAR THORNCLIFFE IRONWORKS, 1810.

Seam.	Distance between seams. Yds. ft. in.	Depth from surface. Yds. ft. in.	Thickness. Ft. in.	
Black Mine ironstone ..	—	42 0 5	6 0	
Park Gate coal	23 0 11	65 0 11	6 6	with top softs.
White Mine ironstone ..	26 2 9	92 0 8	4 0	
Thin coal	1 1 6	93 2 2	2 6	

The top softs in the Park Gate are not workable, being inferior.

PIT SUNK AT MORTOMELY, 1821.

	Depth from surface.	Thickness.
Clay Wood Ironstone............	50 yds. 0 ft. 1 in.......	7 ft. 3 in.
Silkstone coal	63 2 7	2 7—This is the Silkstone tops only.
Distance between	13 2 6	

TANKERSLEY PIT SUNK 1864-65.

Name of seam.	Distance between seams. Yds. ft. in.	Depth from surface. Yds. ft. in.	Thickness of seam. Ft. in.	Remarks.
Black Mine ironstone ..	—	49 0 10	5 10	
Park Gate coal	25 1 0	74 1 10	4 9	exclusive of top softs.
White Mine ironstone..	23 0 0	97 1 10	3 8	is not worked now.
Thin coal..............	3 1 4	101 0 2	2 8	
Claywood ironstone ..	57 0 2	158 0 4	6 8	
Silkstone coal	15 1 6	173 1 10	5 1¼	

It will be seen that in the 174 yards we have workable coal to a depth of 11 ft. 11 in., taking 7½ of dirt of Silkstone coal, which gives 6·23 per cent. for the whole depth, besides the ironstones. The coal field may, therefore, be described, as an exceptionally good one, being comparatively free from large throws, having a good proportion of seams, the quality of which is excellent, and being, as we shall see, not over burdened with water. We will now proceed to notice the various seams, their quality, thickness, &c., and the extent to which they are worked, taking, first, the coals, and, second, the ironstones.

THE COALS: No. 1.—The Park Gate Coal: The average section of this seam over the whole seam will be—

Brazils	1 ft. 0 in.	
Hards	2 4	
Dirt	0 3	
Softs	1 5	= 5 ft.; 4 ft. 9 in. of workable coal.

Formerly this coal was worked by perpendicular shafts, but as these getting more on the dip reached the top of the hill above Thorncliffe, it was found that a continuance of this method would necessitate an engine on the top to pull the coal out of the valley beyond, as the coal was required at the works. A driftway was, therefore, started into the hill side below the outcrop of the coal, and driven in till the coal was reached. It was then continued through the old works till the solid coal was gained, and driven forwards from this point in the coal itself. The length of this driftway, or inclined plane, to the point at which the levels are started out is 944 yards. The direction will be north 60 east, the rise 1 in 12. It has yet 600 yards more to go before reaching the main throw; through the old works it is walled, arched, and inverted. Where the coal is reached the road is driven 8 ft. 6 in. by 4 ft. 6 in. To draw the coal up the incline an engine with two 18-in. cylinders, driving a drum on the second motion, is fixed under the pit hill, which is constructed on the top of the engine-house. The ropes are taken round two large pulleys at the end of the platform and down the plane. About 24 corves, each containing 6 cwts. of coal, are drawn up at one time, the empty corves pulling out the other rope. About four minutes from top to bottom is the speed. The roadway in this incline is of the most permanent kind, being laid with rails of 32 lbs. to the yard, with fish-joints and chairs keyed down to the sleepers. It is seldom, if ever, that an accident occurs from getting off the road. The levels are started, as before stated, 944 yards from the top of the incline, to the north and south. It should be remembered that about 12 yards down the incline No. 3 throw is crossed, and that the top of incline is in Thorncliffe Ironworks. The south levels are driven just 1760 yards from the incline plane. No throw has been met with on this side of the pit in the levels. The north levels are driven about 1000 yards out: 500 yards from the incline throw No. 2 is met with; here it is 12 yards a dip throw to the north. It will be seen that these workings are much further to the dip than any other (600 yards from the main throw); being the top seam it was worked first.

The system of working this coal is to drive three levels, the low level for water, the middle level for hurrying and horse-road, the top or bank level, to turn the banks out of: 20 yards is left between each. The system, however, is not thoroughly long-wall, for bordgates are driven every 400 or 500 yards, and cross pack gates constructed through the goaf from time to time on each side of the bordgate. When the level on the rise is reached the bord-gate posts are brought back in a face. Towards the far end on the south side the coal gets very thin, and is consequently very expensive to work.

The ventilation of this seam is comparatively easy; there is very little gas. At the far end of the south side workings a pit sunk some years ago has been driven into, which constitutes the downcast for that side, the north side being fed from the incline itself. The furnace shaft is situate 560 yards down the incline, and 15 yards away from it; it is 100 yards deep and 10 ft. diameter. The fire-bar surface is 8 ft. by 7 ft. The average quantity of air passing on both sides will be about 31,000 cubic feet per minute. A pumping-engine is erected at the bottom of the incline for the purpose of pumping the water to the bottom of the upcast shaft, from which point it runs along the old level into the driftway elsewhere mentioned. The boiler is at the bottom of the upcast-shaft, and the steam is carried down the return air-road. The engine exhausts into the sump, the apparatus for condensing the steam being a complete success. This engine is also to be applied for driving a tail-rope along the levels, but the arrangements are not yet complete.

The Parkgate seam consists of Brazils. This is a first-class house coal, now well appreciated in the London market, where it commands a ready sale. Formerly it was often often left in the pit, as no one would take it. As one of the old weighmen said on speaking to him about it—"Oh, sir, I should think there are hundreds and thousands a tons buried; its a great shame, and one a't best kitchen coals i't world." The hards, 2 ft. 4 in., or nearly half the seam, are made into coke for furnace purposes, and capital coke they make. They are mostly used at the ironworks, though some are sold. The softs are used for gas-making, and as engine coal, the principal market for them being Sheffield.

No. 2.—THE THIN COAL: There is at present only one shaft drawing out of this coal, and that is the shaft which was mentioned before, where the water from the Silkstone coal is pumped. The water is only lifted to the Thin coal, where it enters a driftway, the utility and construction of which will be afterwards explained. This shaft is 10 ft. diameter, and about 160 yards deep to the Silkstone. It is fitted with wood conductors at the end of the cage, instead of the side. The cages have only one deck, and are only capable of drawing one corf at once. The Silkstone seam was formerly drawn at this pit. The drawing-engine is a horizontal high-pressure, with 16-in. cylinders (double engine); stroke, 2 ft. 6 in.; drum, 10 ft. diameter; round wire-ropes. The quantity raised is only small at present, but will shortly be increased—120 tons per day. The corves hold 5 cwts. each. The thickness of the seam is 2 ft. 8 in.

The underground workings in this coal are not extensive at present. The levels have gone about 500 yards to the south side of the shaft, and on the north about 400 yards past Tankersley pit, which is on the same line of level, and about 1100 yards north of this shaft. The mode of working this coal differs from the Parkgate, being a modification of the bord and pillar of the Barnsley district. Two levels are driven—the low level for water and air, the other for a horse road, being dinted to the height of 5 ft. Bord-gates are driven every 150 yards, and endings every 40 yards up the bords. Two leading banks are taken up the centre of the block thus made, and one following up bank on either side. The bords are then posted back. The bord-gates are not dinted at all, small corves being used for running up them, and a tipping place at the bottom of each bord for emptying into the larger corves, which run along the level. The coal being a very hard one, does not suffer much from this mode of dealing with it. On account of the thinness of this seam, and the large amount of dintage, this coal is a very expensive one to get, and scarcity of hands is sometimes felt. This coal was used formerly, when the furnaces were on cold-blast, for iron smelting, being coked, the Parkgate coal having too much sulphur in it for cold-blast purposes. Since the hot-blast was put on, however, the Parkgate hards have superseded it, on account of their cheapness, and the working of this seam has been comparatively neglected. It is now, however, commanding a ready sale in London and elsewhere as a house coal, for which it is in every way suited, being for heat and durability seldom excelled.

No. 3.—THE SILKSTONE COAL: There are three pits drawing coal from this seam—1, Tankersley pit; 2, Norfolk pit; 3, Staindrop.

1.—TANKERSLEY PIT: This is the principal shaft of the colliery, and is well fitted up in every respect. The drawing-engine is a vertical, high-pressure, double engine; cylinders, 18 in. diameter; length of stroke, 3 ft.; drum, 12 ft. diameter; steam-gauge on boilers, 55 lbs.; horse-power (actual), 120. The depth of the shaft is 174 yards; diameter, 12 ft. The pulleys are 16 ft. diameter. The cages are single-deckers, for two corves, end to end. The conductors are at the end of the cages, and of wood. The corves contain, on an average, 6 cwts. of coal each. The ropes are best round wire, 1¼-in. diameter. The engines are capable of drawing above 600 tons per day of eight hours, which is the time the colliers of this district work, but in consequence of the workings not being fully developed the present output is only 450 tons per day. This is gradually being increased. The screens are six in number, four for best house coals, and two for softs or gas coal. There is also an air-compressing engine on the surface, for the purpose of supplying air to drive an engine in the bottom of the shaft, which draws the coal from the dip workings. The underground workings of this pit are principally on the dip of the shaft. We have already mentioned the levels which run past the shaft bottom. Most of the coal, however, on the rise side of these levels has been worked, the levels being kept open to carry the water forward to the pumping-shaft. Little or no water is found in the coal at this depth; the whole of the water comes from the old workings, which have gone close to the surface, and so let in the surface water. The incline plane starts away from the shaft at the degree north 60 east. It is at present 500 yards long. It is laid in the same way as the one to the Parkgate coal, with the exception of one road, which is laid with the Belgian iron sleeper of Monseur A. Legrand, which answers its purpose very well indeed. It is at the present time 500 yards long. The degree is altered at this point to north 78¾ east, to avoid the roll mentioned on the north side of Tankersley pit, and the driving forward on the dip bord has just commenced. There will be 600 yards to go to the main throw. At 500 yards down the incline the levels north and south are started out. The level line here is north 7 to 15 west. The north levels go 700 yards to the boundary. The south levels go 700 yards, at which point throw No. 1 has been reached, but not crossed to prove it. Preparations are being made for carrying these levels forward through the throw. The method of working the coal is again different in this seam. Every 200 yards along the level a pair of bord-gates are driven to the rise, the front or straight bord 5 ft. for hurrying, the back bord to answer for a leading bank 9 ft. Every 40 yards up the straight bord an ending is driven into the back bord of the former set. When driven through, a bank 14 yards long is taken up along side the back bord till the next ending is reached, when the man who has driven on that ending takes the bank forward to the ending above. The man in the first ending returns, and takes another 14 yards of his ending, working it up in like manner. When the whole of the middle block has thus been worked out, the bord post is brought back from the rise. Each set is thus aired with fresh air, the level above being the return air-road. It is in this seam, and in this portion of it, that those outbursts of gas occur which we read of recently with so much interest in a paper before the Midland Mining Institute, by Mr. W. Hoole Chambers, and which render life and property so very precarious. Happily, by judicious measures, since the present system of ventilation was adopted, no loss of life or property has taken place at this colliery from them, although it has suffered in a far greater degree than any other. It is to be hoped that the energetic discipline which is carried on in every branch of the management will be steadily pursued, and that its result may be as heretofore, satisfactory in every way. One outburst has occurred since that paper was read, but it in no way differed from those which were there described. The ventilating shaft for this and the Norfolk pit is situate 500 yards on the rise of the Newbiggen pumping-shaft. It is 10 ft. diameter, and about 145 yards deep. The furnace is situate 71 yards away from the bottom of the shaft. It is constructed in No. 2 throw. It consists of two fires along side one another, with a flue between. The fire-bars are about 3 ft. 6 in. from the floor. The side walls go 2 ft. above the fire-bars, and an 8-ft. semi-arch is turned over of fire-brick. The surface of fire-bars in each furnace is 7 ft. by 7 ft., or 49 ft., giving 98 ft. in all. The flues are carried separately from each furnace for 21 yards, each flue being 7 ft. diameter. Here they are both carried into one, the size of which is 5 ft. 6 in. by 4 ft. 6 in. The fronts of the furnaces are entirely closed, both top and bottom, by doors. The fresh air, which comes straight from Newbegin shaft to the fires, is admitted by flues constructed in the floor, underneath the fire-bars. From 9000 to 10,000 cubic feet per minute is consumed for the furnace. The total return air passing through the workings is 71,000 cubic feet per minute; about 20,000 for the Norfolk district and 51,000 for Tankersley.

The average section of coal in this part of the seam will be—the top (hards) coal, 2 ft. 9 in.; dirt, 7½ in.; bottom (softs) coal, 1 ft. 9 in.; workable coal, 4 ft. 6 in. The top hards are the celebrated Silkstone house coal so well known in the London market and elsewhere. This pit produces the best sample of these coals known in the kingdom. The bottom softs are well known as a superior gas-making coal. The slack is washed, and converted into coke for steel smelting.

2.—NORFOLK PIT: This shaft (10 ft. diameter) is sunk near Thorncliffe Ironworks, on the south side of No. 3 throw. The engine is a vertical high-pressure winding-engine, on the same principle as Tankersley, but smaller. The cages are two-decker cages. The pit is 100 yards deep. On account of the extreme thinness of this coal, and its hardness on the south side of the shaft, and the number of small throws in it the working is very expensive, and it requires great care in working.

At No. 3 throw a remarkable change takes place in the nature of the seam; the bottom softs disappear altogether, and the tops are 2 ft. 8 in. in height. Further south, at Grange Lane, the next colliery working this coal, the softs are found 14 yards below the tops, and it is to be presumed that such will be the case here, but not being worth working by themselves no attempt has yet been made to discover them. Further south, from the shaft the coal gets thinner, near the face of the levels it is only 2 ft. in height. A dip bord has been driven from the shaft (north 70° east) to the throw No. 3. The throw was found 220 yards down bord. From here a south level was started. Direction about south 10° east, 530 yards along this level a bord was again started to find the throw. It was found to be 80 yards from it. So that at this part the fault runs much below water level. The system of work of this coal is a modification of the long wall.

Before leaving this part of the Silkstone seam let us look at the pumping-engine. It is a vertical high-pressure engine, the beam working under the cylinder. It was fitted up as a condenser, but the scarcity of water on the surface enforced the abandonment of that idea. The diameter of cylinder is 36 in. The length of stroke 7 ft. The pressure of steam on boilers is 50 lbs. The actual horse-power 127. The diameter of ram 16 in. The length of its stroke 7 ft. The average number of strokes per minute is 6 (during the winter it is often 9). The number of gallons raised a depth of 65 yards is 300 per minute. We have mentioned a driftway goes past this pit at the thin coal, which drains the whole of the coal field. It was constructed at the joint expense of Earl Fitzwilliam and Messrs. Newton, Chambers, and Co. It begins at Elsecar, and is driven through Earl Fitzwilliam's coal field and that under notice, coming along side No. 2 throw, from the point where it joins the main one, till it foots the Silkstone coal just above the Newbegin furnace shaft. It is just 60 yards above the Silkstone seam at the pumping-shaft. The driftway is nearly level the whole way, and is about three miles long. The water in the pits is totally unfit for boiler purposes, it only being used in very dry seasons. Some notion may be formed of its iron-eating properties when it is stated that although the present engine was only started in 1863 this is the third ram which has been put in, and it is now more than half worn out.

3.—STAIRDROP PIT: This pit is 9 ft. diameter, sunk to the Silkstone coal on the rise side of Thorncliffe Ironworks, 60 yards deep, having a separate furnace shaft and pumping-engine. It has no connection underground with the other Silkstone coal pits, a barrier being left below the levels, in order to prevent the water, of which there is a large quantity, from going into the lower workings of Tankersley and Norfolk pits. The pit is an old one, and nearly worked out, and nothing requires particular notice in connection with it. The seam is about 3 ft. 4 in., having a small quantity of softs. The out-put will be about 80 tons per day.

The quantity of coal drawn at the collieries has been so very varied, on account of the frequent stoppages and disturbances, that the few last years give no accurate account of their capabilities. The output this year, if everything is favourable, will, probably, considerably exceed 300,000 tons. Of ironstones three have been mentioned, but the White Mine has not been worked for some years, on account of its poor quality, and the extreme expensiveness of working it. None of the ironstones are being very extensively worked at present. When the last strike began, only one furnace was kept in blast. The quantity of ironstone in stock was very large, so a number of ironstone pits were abandoned for a time. At one time only one pit was kept at work. The Black Mine, which is nearest the surface, and the best ironstone on the ground, is being worked by two engine-pits in the Duke of Norfolk's property. The plan of working the stone is thorough long wall. The goaf is packed solid and even, then a large quantity of shale has to be drawn to the surface. An engine-pit is also being re-opened to this seam in Earl Fitzwilliam's property. The present out-put will be about 120 tons per week, which will shortly be doubled. The Claywood ironstone is 14 yards above the Silkstone coal, although in the section given it is more thickly stoned than the Black Mine. Such is not generally the case, and the quality, although very good, is not equal to the Black Mine. The only pits working this seam at present are some old-fashioned gin-pits, the stone and shale being drawn up by a horse. They are situate on the rise side of Thorncliffe Ironworks. There are five of them at work; average depth, 25 yards, 8 ft. 6 in. and 9 ft. diameter. Altogether they produce about 140 tons per week. An engine-pit for drawing this stone, sunk near to Tankersley Pit some two years ago, is about to be put in operation as speedily as possible. Fossils are frequently found in these ironstones, and in a throw in the Black Mine, some time ago, a quantity of spar, very closely resembling the Derbyshire spar, was found. The White Mine abounds in sea-shells of various descriptions.

The manufacture of coke is one of the important parts of the business carried on at the above collieries. Steel coke is made from the Silkstone slack washed, and as its name indicates, is used for steel smelting. It commands a ready sale in Sheffield. The mode of washing is at once simple and efficient, and does away with a tramway, which was formerly used to convey the slack from Tankersley Pit to the ovens, a distance of 150 yards. A wooden spout has been erected the whole distance, 9 in. broad and 6 in. deep. The fall will be 3 in. to the yard. The water and slack are let in at the top, and the water carries the slack before it. At the centre of the distance the spout is enlarged into two, the centre partition being fitted with a long iron tongue, enabling the man in charge to turn the slack and water in which side he thinks proper. Two small iron straps are fitted into each spout at this point, about 5 yards apart, and standing about 1½ inches above the bottom of the spout; these serve to catch the dirt, which, being the heavier, settles to the bottom, behind the straps. When one side gets full of dirt, and the dirt begins to go over the straps, the water and slack is turned into the other spout, and the one at liberty cleaned out. Large hoppers are fitted up at the bottom to receive the slack, and it is allowed to drain itself of water. The water passes into a pond, having narrow passages backwards and forwards, to allow the coal dust to settle from it, when it is pumped up and used over again. The passages are cleaned out one by one as they get full of dust, and are so arranged that any one of them may be shut off from the rest without interfering with the passage of the water through the others.

The Parkgate hard coal is made into furnace coke both for home consumption and for sale. The number of ovens altogether upon the ground in working order just now is 158. The number of tons of coke made per day is 106, or 636 tons per week; this is exclusive of the 30 ovens just erected by the Coppée Coal Company, which are standing till their washing machine is in working order. The railway accommodation required for such an extensive concern is, of course, large. Although close to the South Yorkshire Railway, the ironworks and some parts of the pits are so much below the level of the railway that a long siding had to be constructed to convey the goods and coal on to the main line. Some idea of the numerous lines necessary may be gathered from the fact that at the last stock taking there was no less than 11,522 yards of railway in operation, or 6 miles 962 yards. Two locomotives are at work every day for conveying the goods and coal along these lines, and one is kept in reserve in case of accidents, and to relieve during repairs. Two of these were made by Manning, Wardle, and Co., of Leeds, and are three coupled engines, with small wheels suitable for steep inclines. Altogether, this colliery is one of the most extensive in South Yorkshire; its development to the fullest extent is not yet accomplished, not on account of want of trade, but because of the circumstances which were named at the commencement of this paper. Its advantages are great, its drawbacks are also not few. According to all that can be seen, its resources are much greater than have yet been tried, but there is every probability of its being very quickly placed in a much higher scale as regards production than it holds at present.

BIRMINGHAM AND THE BLACK COUNTRY—No. XII.

THE WORKS OF MESSRS. THORNEYCROFT AND CO.

In the Supplement to the *Mining Journal* for April 8 a description was given of the Messrs. Thorneycroft and Co.'s Blast Furnaces at Bradeley, and it was then remarked that this firm was comprised of gentlemen of the highest standing in connection with the manufacture of iron. It is now our intention to notice the Shrubbery and Swan Garden Ironworks, situate at Wolverhampton, where all the finished iron is made. These works are as extensive as almost any in the Black Country, and few can boast the reputation they enjoy as producers of boiler and other classes of plates and sheets, and heavy merchant iron. Messrs. Thorneycroft and Co., with little difficulty, are able to find a ready market for their produce, and as a proof of the demand we may state that at the present time they are starting the plate and heavy merchant mills on Monday mornings. It is in these works that the knowledge and experience of the members of the firm are brought into play, and the result is that, with comparative ease, a uniform article is produced, of good quality; and although some portions of the works are very old, they are by little contrivances and additions made to answer the purpose for which they are intended admirably. The firm are also fortunate in the choice of their manager, Mr. Wright, for he is not only a thoroughly practical man, but is able to combine with his practice some amount of theoretical knowledge. We mention this fact because such men are not often found officiating as managers in South Staffordshire; it would be greatly to the advantage of the district were it otherwise. It can hardly be wondered at that such a state of things is in existence when we find many of the ironmasters setting their faces against theory, and entirely ignoring it, for the simple reason that they are only practical men themselves. They form a poor estimate of theory, as they would have it tested independently of practice, and consequently they find it of little or no avail. It is well known that practice will do without theory, but theory will not do without practice; the two combined will accomplish almost anything. As an illustration of what we state, we may mention a case where a metallurgist of some repute visited an ironworks for the purpose of suggesting some improvements in the manufacture. He gave the manager—who, by the way, was rather a sharp fellow, and had some little knowledge of chemicals—instruction to put certain compounds into the puddling furnace, and remarked that such and such a result would follow; but the manager, by some peculiarities in the manipulation, not detected by the chemist, produced an entirely dif-

ferent result, and then held the knowledge of the latter up to ridicule, afterwards acknowledging privately that had he carried out the instruction properly the result would have been as desired, but he did not like being interfered with.

Messrs. Thorneycroft and Co. combine theory and practice, to their great advantage. This firm is able to turn out larger plates and bars than any other in the district. Large angles 10 in. by 3½ in., and 9 in. by 3 in., by 40 to 50 ft. in length, are rolled. Rounds 7 in. diameter by 16 ft. in length, and 5 in. diameter by 35 ft. to 40 ft. in length, and other bars and sections in proportion, are manufactured. Plates are made up to 6 ft. 8 in. wide by 12 ft. in length, and 5 ft. wide by 14 ft. long, by 1 in. thick.

Commencing with the forges of the Shrubbery Works, on the left hand side of the turnpike road looking towards Wolverhampton, we have first a condensing beam engine, with a cylinder 39 inches diameter and a stroke of 7 feet. From this engine are driven a large helve and a forge train. There are 12 puddling furnaces and one ball furnace in this forge. In the second forge there is a condensing beam engine, with a cylinder 38 in. diameter and stroke 6 ft. From this are driven two forge trains, a helve, and a set of "bull-dog" crushing rolls. In this forge there are 12 puddling furnaces and one ball furnace. The steam for the two foregoing engines is raised in five vertical boilers, heated by the furnaces. Outside the forges stand two kilns, in which the "bull-dog" is calcined. An engine with cylinder 22 in. diameter and stroke of 5 ft., supplied with steam from a large cylindrical boiler, has attached to it a blowing cylinder, or tub, which produces all the blast required for a small refinery, two charcoal fires, and a large number of blacksmiths' fires. From the same engine there is also driven a planishing hammer, and there are two furnaces for heating the iron to be planished. A 4-ton steam-hammer works the charcoal balls, and stands very near the fires. This hammer was made at the works, and nothing could speak stronger in favour of the quality of Messrs. Thorneycroft and Co.'s iron than does the piston-rod, for we never yet saw one of so small diameter lifting a 4-ton hammer block, and this is all the more remarkable as the hammer is a very old one, and the block is extremely loose in the slides. The hammer has its steam from a cylindrical firing boiler. The next condensing beam engine has a cylinder 48 in. diameter and stroke of 7 ft., and stands between a 12-in. mill and a forge. On the one side there is the 12-in. mill, with its two heating furnaces, and on the other the forge train,-helve, nine puddling furnaces, and one ball furnace. There are also one small and two large pairs of shears. The engine obtains its steam from four vertical furnace boilers. Crossing to the continuation of the works on the other side of the road, we come first to a condensing beam engine, driving three pairs of shears and a splitting shears. The strong shears all through the works are upon the cam system. This engine has a cylinder 17 in. diameter, and works a 4-ft. stroke; the shears driven from it are for cutting the bars from the large merchant mills. The large mill engine is of the condensing beam class, and has a cylinder 54 in. diameter and a 7-ft. stroke. It drives on the one side a 21-in. merchant mill and a 16-in. mill, placed parallel to each other, but leaving plenty of space between. There is a pair of 21-in. rolls, equidistant to each mill, for running some of the iron through preparatory to taking it to the mills. The 21-in. mill is fitted with a reversing gear, and well calculated to turn out large sizes of bars, angles, tees, rounds, squares, &c. There are two heating furnaces to each of the mills. One of these furnaces has been so arranged by the manager that piles 12 ft. in length can be heated throughout with perfect uniformity. To the 16-in. mill there is a band-saw, and to the 21-in. mill a Smith's steam saw. We will here give a brief description of this latter machine, as it has been mentioned in every ironworks we have noticed, and will be found in nearly all the leading iron and steel works throughout Great Britain. It is a very simple machine, and was invented by Mr. Smith, engineer, of Dudley; it stands on very little space, and is yet so effective that we saw it at Messrs. Thorneycroft and Co.'s works cutting through a hot shaft 8 in. square. At one end of a cast-iron bed plate is fixed a steam chest, in which there is a circular hollow casting, having four necks or outlets in its circumference. The steam is introduced through a cock at the side of the steam chest into the hollow of the circular casting; the steam in escaping through the four necks beats against the steam chest, and causes the circular casting to revolve, and with it a spindle on which it is fixed. The spindle passes through the end of the steam chest and two carriages, and has at its opposite end the saw. Between the carriages there is a small fly-wheel. The bars to be cut are drawn up to the saw by levers connected with a sliding table. Near the large mills there is a small steam scarfing hammer. The plate mills are on the other side of this large engine; there are two mills placed parallel to each other, and a large pair of rolls, fitted with reversing gear, at right angles with the mills; these are for rolling the heaviest descriptions of plates. There are two heating furnaces to each mill. At these mills are two small lever shears and two powerful shears, worked by cams, one 8 feet long in the blades, which will cut a plate of any length, and the other 10 feet, taking that length off at one cut. There is in course of erection a pair of extraordinary dimensions, which will take off a length of 16 feet at one cut. The steam for the large mill engine is obtained from four furnace and two firing boilers; there is also a firing boiler raising steam for the saw. The Stour Valley forge has a condensing beam engine, with cylinder 34 in. diameter and 6-ft. stroke; from it are driven two forge trains, one helve, a "bull-dog" crushing mill, and cutting down shears. There are 11 puddling furnaces and one ball furnace. The guide mill is worked by a condensing beam engine, with cylinder 24 in. diameter and a 5-ft. stroke; connected with it are the guide mill and two pairs of shears. Here there are two heating furnaces and two boilers erected. Near the plate mill there is a small high pressure vertical engine, with 10-inch cylinder and 1 ft. 6 in. stroke, driving a pair of 8-ft. cam shears, capable of cutting up to 2 in. in thickness. Messrs. Thorneycroft and Co. make and repair all their own machinery; the fitting shop at the Shrubbery Works contains three lathes, two drilling machines, one planing machine, a screwing machine, and shaping machine; there are also several presses for stamping buckles for cotton bale hoops. Motion is given to this machinery by a high pressure engine, with 14-in. cylinder and 3-ft. stroke, which also drives three roll lathes, employed in turning the rolls used in the works. Steam is obtained from two cylindrical boilers. The principal offices of the firm are at these works. There is every accommodation for carriage of the manufactured material, as both the railway and the canal run into the works.

The Swan Garden Ironworks are at some little distance from the Shrubbery. The first part we come to is the forges. These are of modern construction, and very well arranged. There is near the centre a condensing beam engine, with a cylinder 48 in. diameter, and working a stroke of 7 ft. Near the engine there are three forge trains and two helves; it also drives shears and a "bull-dog" crushing mill. There are 20 puddling furnaces, placed so as to nearly surround the machinery, the only exception being at the back of the rolls, where the puddled bars are drawn out. The steam for the engine is generated in three furnace boilers and one firing boiler. In these works there is another forge, containing a condensing beam engine, having a cylinder 31-in. diameter and working a 6-ft stroke. Driven from it there is a forge train, a helve, and two shears. There are ten puddling furnaces in this forge, and four furnace boilers. A condensing beam engine, with cylinder 44-inches diameter and a stroke of 7 feet, drives two tank mills, so called as they are chiefly employed rolling plates for tanks, a 16-inch merchant mill, and a slitting mill; the 16-inch mill is fitted with reversing gear. To the tank mills there are two heating and two annealing furnaces, and to the other mills three heating furnaces. A saw, driven by a band, cuts the ends of the bars, &c., from the 16-inch mill. The hoop mill is connected to a condensing beam engine, with 42-inch cylinder and 5-feet stroke. There is also worked from the same engine a small sheet mill. To these mills there are three heating and one annealing furnace. Two sheet mills are driven by a condensing beam engine, with 34-inch cylinder and 6-feet stroke, and these mills have four pairs of shears, and one annealing and two heating furnaces. In the works there is a small blast engine, with 16-inch cylinder and 4-feet stroke, and a high pressure engine, with 17-inch cylinder and 2 feet 6 inches stroke, driving shears; there are also nine boilers we have not mentioned. At a small fitting shop a few machines are driven by a high pressure engine, with 14-inch cylinder and 3-feet stroke. Adjoining these works there is a large foundry, where the rolls and machinery castings for the works are made. The iron is melted in two large Clayton's air furnaces, and the foundry is fitted with strong cranes.

COLLIERY VENTILATION.

SIR,—The question does not appear to be even yet entirely settled as to whether the suction or the propulsion of the air is preferable in the ventilation of a colliery, and I think it would be a very fair question for discussion in the *Mining Journal*. The reason I think it worth discussing is because an inventor who has been long employed in collieries is desirous of patenting an invention for ventilating a pit by forcing in the air, and he tells me that by this means explosions will be impossible, and thus the working of collieries would be safer. He proposes to nearly close the upcast shaft, and quite close the downcast, admitting the compressed air for ventilation at the downcast shaft. So far his idea is like that of Mr. Colwell, but he has an improved and very simple machine for setting the air in motion. The advantage claimed for propulsion is that as the mine will be filled with compressed instead of with attenuated air the fire-damp will be kept back in the coal, and will not be continually sucked out as at present, less air being, therefore, required to keep the mine equally safe.

I do not doubt that ventilation by propulsion has these advantages, but I do not know whether they are more than compensated for by the drawbacks. In the first place, the friction of the air would, I fear, be much greater when propelled, so that the passage of a given quantity of air through a pit would require much more horse-power if effected by propulsion than by suction; and the propulsion system seems to have another objection, which is that the moment any stoppage of the engine took place that moment the ventilation would cease; and, worse still, the pent up fire-damp, accumulated to ten times the extent at present possible, would all be suddenly released, and we might expect an explosion surpassing in severity any we have experienced. Now, I should like to know whether this can be remedied either by bore-holes for the gas to escape through or by any other means?—*May* 31. COAL.

TRADES UNIONISM, AND INDUSTRIAL PROGRESS.

SIR,—Public interest being excited on this subject through recent legislation and the Commission of Enquiry, much having been said and written also on the influence of these "societies" for good or evil, from a public point of view, it might be interesting to glance at the comparative private effects of Unionism on districts and individuals, as shown in loss of trade and loss of character, passing over the shooting and assassination of industrious men, who only require freedom of action to pursue their respective avocations quietly, the blowing up of defenceless women and children when asleep, the maiming of innocent animals, picketing, rattening, and terrorism generally, as exercised under the direction of trade societies on their unfortunate victims; and turning to the agitators themselves, who clamour for the rights of working men, and declaim against the tyranny of masters, yet tyrannize over their fellows in a manner truly wonderful, even if exercised over a race of semi-savages; and more astonishing still, that men who aspire to the rights of British citizens should endure this treatment, who boast of suppressing slavery, and sending missions to the heathen, yet remain in the most abject degrading slavery and humiliation themselves, to an extent little known by the world in general. Leaving the slavish condition of individuals, and directing attention to districts, and the effects of combination, as seen in a western port of ancient renown in the annals of discovery and trade in the early times, when her ships sailed forth contemporary with those of Spain, and Columbus found a worthy rival in Sebastian Cabot, steering westward on their great mission, eager to open up new channels of intercourse with distant lands, the very existence of which at that day was considered doubtful. The results of their labours are so well known, that a passing allusion to the trade established at an early date with Virginia and the African coast is all that can be necessary; and the historical negro's head depicted on the packets of Bristol tobacco has doubtless excited the wonder of successive generations; the wood-cut or (whatever else it might be) of to day on the packets in question might be coeval with the introduction of the weed. So much for progress. Raleigh and Drake even might have admired it, the cut, when the Invincible Armada was signalled. Macaulay has described the following night, and the memorable—

> "Three hundred horse which ere the morn, had met on Clifton Down."

The riders, let us hope, solaced themselves with bird's eye, or some other mixture. Rip van Winkle, awakening from his celebrated slumber, might have seen ships from the famous old port in New York Bay, before the Mersey had become a haven for American liners. But the relative position of the Mersey, Clyde, and Avon needs no comment now as to the ocean-borne commerce from the new world or the older centres of trade. Yet within memory of many now living a great revolution has been effected on the banks of the Avon, in the matter of steam navigation, and at the time when the Great Western was running to New York, and some of the first West India mail steamers were being built, with many others for the Irish and coasting trades, showed as if the sun of a great future had risen for Bristol. Day and night, almost without intermission, the hammering of ships and locomotive builders was heard, and amongst those who in the imagery of a well-known poet—

> "Look'd into the future, far as human eye could see,"

and who saw that with docks at the mouth of the river the old city must long retain a foremost place as a great commercial centre; and in view of the great prospective requirements of the metropolis with the port in question, a noble line of railway was laid equal to almost any demand for transit of passengers and goods, at a speed of 60 or 70 miles per hour, or within two hours of London, that the capacities of the road and engines were greater than the traffic required has been proved since and cannot be denied, simply because I. K. Brunel, was not properly seconded in his efforts to secure the ocean trade. On his part the largest iron ship ever attempted was built to help them; but, alas for human hopes, in forcing benefits on his fellow-creatures, and which their dull vision cannot comprehend until too late. Let us hope, however, since his beautifully designed bridge is at length spanning the river, displacing the basket, which was occasionally drawn across, suspended on a line, from the massive towers, the community will soon recognise the necessity of discarding their comparative baskets, or sailing ships, as a means of communication with other lands. The ship already mentioned has been and is now without doubt one of the finest ships afloat, taking the time of her construction into consideration, and the celebrated steamship Great Britain on her voyage between Liverpool and Melbourne has attained a world-wide reputation for the ship. A challenge to the world, emanating from the city in question, looks hopeful in an advertisement. It is possible that the builders of the Great Britain and other fine ships have again taken courage, and forthwith challenge the world in iron shipbuilding, as well they might in such a locality for coals and iron, the essentials to this branch of industry; but an examination of the challenge shows that steam or steamers is not mentioned. What, then, is it all about, this flourish of trumpets, since the great iron foundries and machine shops are comparatively quiet? Merely announcing that from fitting first-class ocean steamers and locomotives, they can yet challenge the world in lethargy, and in the production of articles at—"2s. each!" Truly a marvel for men forced into the path of progress by the genius of a Brunel, the man who would have been happy to have seen a dock for his pet the Great Eastern near the mouth of the Avon; and which, by the way, is a matter not so difficult of attainment, and the ship in question might yet become the admiration of the mercantile world, with some modification, getting rid of the paddle engines, reducing passenger space, &c. But now for the cause of retrogression—lack of energy, trade societies, and combinations are mainly responsible for the decline of marine and locomotive engineering at Bristol.

An instance or two must suffice. In the boiler-making department of a certain establishment a steam rivetting machine was introduced, and proved moderately successful, but the men could not tolerate the innovation, as being against their supposed interest. The machine must be disabled: to effect this a rivet of hardened steel was inserted instead of the heated iron rivet.—Result: Machine broke down, and in such a manner that the offender escaped detection. And this is only one of the many nefarious tricks practised in the workman's interest, if driving all classes of good paying work into other hands, and even into other lands, can be called his interest. It accomplishes that object. But the boiler makers are not alone responsible for curtailing the hours of labour: they of course fix the number of rivets to be driven per day, refusing to work with any but society men, &c., or under heavy penalties.

The Amalgamated Engineers also claim honourable mention (such as it is) for their efforts in restricting the amount of work to be done per day, the abolition of piecework and overtime, dictating to employers the number of apprentices to be engaged, compelling the discharge of thoroughly efficient men if they had not served a full period of apprenticeship, refusing to admit non-Unionists, &c., where they hold sway; and these are the men who complain of the tyranny of masters. We need not stop to enquire if London and Bristol can expect a return to former activity in the march of progress, iron shipbuilding included.

Have the grounds on which "trade societies" claim public sympathy been satisfactorily examined? The tyranny of capital, or employers over workmen, appears to be the fundamental complaint, or "standing menace," under which all grievances, supposed or real, might be arraigned—the text for pot-house oratory and platform lucubrations of demagogues and agitators, who, having set themselves apart (a self-elected priesthood), and, to coin a word for the occasion, the Dem-Agitators—exhorting the toiling millions to supply them, the self-elected, with beer and tobacco at first, and who soon claim gin and tobacco from their slaves and dupes, and, further, to be elected M.P.'s, &c.

But a question arises—if it will pay to cripple the industries of the country, and lead the toilers into idleness and dissipation, families into destitution and direct poverty, that those wasps in the hive of industry shall consume the honey? Truly, the Dem-Agitator doth not proclaim aloud that he prefers destruction of the hive to falling back on honest work; yet his actions are transparent enough. But, returning to Bristol, notwithstanding the lack of energy which allowed the flood-tide of Fortune to ebb so low for the commerce of the port, and for which trade societies cannot be held directly responsible. Since 1850 it has been my lot to hear first-class mechanics (in other lands) curse the trade societies, which ruined Bristol as a leading centre of mechanical skill. A skilled mechanic assured me that for a period of fifteen years he had earned on an average 4*l.* per week in that city; but when the crash came, the expensive habits acquired in the days of high wages, piecework, and overtime compelled him to emigrate, with his family, and begin the world again in the afternoon of life; whilst many others had sunk so helplessly deep in misery that hope died within them, and soon the friendly shelter of the grave ended their privations.

Referring to London and the societies there, recently a case of tyranny was reported in the papers. A contract for building two iron ships was offered to a firm on the Thames, which was standing comparatively idle; but previous to accepting the contract the masters had to consult with their artizans, as to whether they would kindly accept work on very fair terms to the men themselves, but quite unremunerative to the employers, merely to keep their staff together, with a promise of increased pay as business revived. The "societies" could not reply at once, but called a meeting, and decided not to accept work under an additional 6d. per day. The gentleman who offered the contract having no time to waste over their meetings, very properly immediately transferred his work to the Clyde. Who, then, are the tyrants in this case?

Yet another instance in the same paper, of a ship in one of the docks requiring repairs. The work was offered at 6s. per day, and there being two shipwrights then breaking stones in one of the East London stone-yards, at 9d. or 1s. per diem, it seemed a fair opportunity for them. Can it be credible that they refused the job, unless 7s. per day was paid, it being against their "society" regulations to work for less! It is not added if it is against their "society" rules that idlers, having no visible means of subsistence, and refusing well-paid work, should be whipped at the cart's tail from Newgate to Tyburn and back, lodged in jail, and kept at the treadmill, on bread and water, for a period of not less than 21 days. Be that as it may, is there no remedy for this tyranny of men over employers, and, worse yet, over their comparatively helpless fellow-workers, unless they conform to "society" regulations? The remedy—is there any? One, at least, is applying itself very diligently indeed, and, for the information of the Sheffield file cutters, cutlers, &c., it might be stated that a firm not far from Christiania, Norway, is now supplying English and German manufacturing firms with files that cannot be surpassed as to quality, even in the "rattening" district itself. Cutlery is also receiving much attention in continental circles, and is already supplanting English articles to an enormous extent. The effects of this will not be so apparent for a time in distant markets, English fabrics having such facilities for shipment; but Hamburg and Bremen will soon remove all hindrance for shipment of German products. The Amalgamated Engineers might be entreated to be reminded that steam-engines—fixed, locomotive, and marine—are being constructed "out of England" for English capitalists, with or without their permission. Thus, in a few years the world will be independent of English machinery, if the Trades Unionists will only persevere in their efforts to cripple the enterprise and trades of the kingdom.

The effects of the system are very apparent in the West of England, and the present or recent strikes in Sunderland and elsewhere are full of encouragement for the foreign establishments. Door and window frames, with flooring-boards ready tongued and grooved, can be delivered in English ports at prices below English work; this should be edifying for the carpenters and joiners, who have lately been on strike for reduction of working time and higher pay. However, when it comes to the worst possibly much of the repairing of machinery in this country will be left to English mechanics, even if all the new work is imported from other lands; indeed Belgium has advanced considerably in this matter, if the evidence of the Hull docks can be admitted in the shape of machinery and iron girders imported from that country; this, however, does not apply directly to iron shipbuilding, inasmuch should the societies succeed in driving all that class of work out of England, yet it is gratifying to know it stands on a good basis in Scotland.

The *Mining Journal* of Feb. 25, 1871, contained the following:—"On Thursday the General Steam Navigation Company had launched for their trade between Bristol and Ireland a handsome screw steamer of 1200 tons, and 210-horse power nominal; the vessel is named the Argo," &c. That the Clyde had, perhaps, never so many large vessels on the stocks at one time as they have just now, and are still adding. And yet the Avon is dependent on the Clyde for ships.

It must be conceded, however, that the agitators having succeeded in crushing important branches of industry in England, there are hopeful signs for them even in intelligent Scotland, as per report *Mining Journal*, Feb. 4, 1871. The only works which have not struck in Scotland are those of (Wishaw) Ellis, Coatbridge, Blochairn partially, and Govan (Glasgow). With regard to the latter works their mill engine gave way on January 24, under circumstances which caused the trustees to offer a reward of 100*l.* to anyone who would give such information as would lead to the conviction of any person implicated in causing the destruction of the Govan Bar Ironworks mill engine, &c. Following on this catastrophe, by a strange fatality, the millmen at Blochairn when going forward with their work on the evening of the 24th ult. were startled by the fracture of one of the moving pinions of the driving engine of their plate-mill, tearing up the ponderous mechanism from its bed, and filling the men with alarm. We have not heard that there is any suspicion of foul play having been practised at Blochairn, but it is considered singular, &c. It might be remarked also that it was by no means a public matter when the hardened steel rivet was inserted to break down the rivetting machine at Bristol. Other instances of this nature might be adduced if time and space allowed, and I will merely notice another remedy in passing.

At the works of Messrs. Harvey and Co., engineers, &c., Hayle, Cornwall, they will not employ a recognised society man on any pretence, and employ what number of apprentices they deem proper; and who acquainted with the port of Hayle and its vicinity cannot bear testimony to the good understanding existing between employers

and employed, which enables the firm to take any suitable contract in hand with a certainty of its being completed? The steady deportment of the men, and the comfort of their families, lodged in substantial and even handsome houses, contrasts favourably with any district in the kingdom.

Messrs. Newton, Chambers, and Co., and Mr. Huntsman, for their stand against tyrannical societies, are entitled to the earnest thanks of every industrious free working man in the country. Efforts such as these by the leading firms, supported by the workers also, would cripple the societies in a short time, by allowing every man free action for his work, whether in the field, mine, or factory, and give even the engineers to see that incapacity, even if sheltered behind the ægis of privilege and apprenticeship, must give way before earnestness, unfettered by any man or set of men to limit their action. Through whom, or by what means, might be asked, have this redoubtable body, counting would-be M.P.'s in their midst, acquired the right of doing very little work, yet exacting a fair day's pay, and standing in the way of better men very often? Non-Unionists, assert your rights and maintain your liberties by faithful work in a fair field, asking no favour and fearing no frown. We ask this, and results worth noting would soon follow. The incapables, despite their societies, would soon find their level, and recruits be constantly gathering to the army of progress into the class the only password to which would be earnest capability. Under such a state of things true working leaders would be constantly coming to the front, who contentedly toil day and night to thoroughly master their profession or calling, and eventually in the true order of things become employers in turn.

What show of reason exists that the ardent worker shall divide the fruits of his brain-work with the half-hearted swillers of beer, obstructives in the path of progress, who make no effort except to retard, but with merely animal instinct pass their time in comparative ease? That such as these should expect, much more receive, an equal share with those who truly toil is a most preposterous idea, at least that is the impression of— A WORKING ENGINEER.

Norway, May 20.

INDUSTRIAL AND TECHNICAL EDUCATION.

SIR,—You referred very favourably some time since to a projected university for those desirous of increased technical education, but although I have made many enquiries I cannot find out that much is doing in the matter; there seems to be no "whipper in," and what is promised in the way of support one week is almost forgotten the next. What is the use of mayors of towns merely lending their names to the undertaking, if they do not give their influence and energy as well as their names? Success would sooner follow by John Brown and Thomas Smith really working at it than all the mayors and aldermen in the kingdom putting down their names, and then taking a nap so long that it is like permanent hibernation. The question is, How much money has the University got? If it can appoint only half a dozen professors, and get them to work, the University would quickly grow, and become a great body, like the University of London. An arrangement was suggested in a book published by, I think, a Scotch mining engineer—Mr. Hyslop—which was that each professor should teach at six places each week; I would say five places each week, and he should give one lesson per month at each. In this way 20 places could be served by the six professors, and if each were given 100*l.* a year salary, and 300*l.* a year for travelling and sleeping expenses, 2500*l.* a year would do the whole.

Calculating 2500*l.* for each 20 places served, it would cost but 12,500*l.* to furnish technical education in 100 towns, and as the National University seems to have nearly 100 influential men on the committee, they need only get 125*l.* each to set the whole concern going. I well know workmen would flock in by hundreds if really useful knowledge were offered them, but it must be knowledge that they can turn to good account, because Euclid and similar things they do not want, and, therefore, will not learn. A man may figure away at Euclid for a month, and it will not teach him how to cut a plank to the best advantage, nor how to save material in any way, yet that is what a man wants to know to enable him to command high wages—he must know how to produce so cheaply that the articles he makes can be brought into competition with those made by others. If he can do this he can easily get high wages, for every manufacturer must do his best to undersell his neighbour. As a rule, merchants care nothing about price so long as it is the lowest in the market, and as they are paid by percentage, they prefer buying an article that costs 20*l.* rather than one that costs but 2*l.* This is only natural, but the merchant must have the best obtainable at a given price, in order to keep himself right with his customers.

I know nothing about how such companies are floated, but it seems to me only common sense that each of the committeemen should set to work, and get each of the people over whom he has influence to put down their names as annual subscribers, and if each mayor, &c., only got 500 annual subscribers of 10s. each, the treasurer would have actually more money than required. Or if they put some foremen in factories on the committee, and gave them a percentage on the subscriptions they obtained, even the mayors might be left alone, and still the money would be forthcoming. But anyhow there must be more people to take an interest in the concern if it is really intended to make it go. Have any professors been yet appointed? and if not will some of the officials state through the Journal what is suggested as qualifications for the professors, and whether they have any in view ready to appoint? A. O. F.

LITHOFRACTEUR.

SIR,—In your last impression I observed a letter, signed "Gun-Cotton," in which one or two points are raised by the writer respecting the new explosive compound, lithofracteur. I should be glad if you would allow me to offer a few remarks in reply thereto, knowing, as I do, something of the subject, as my card enclosed will assure you. Your correspondent first questions the mechanical stability of lithofracteur. I myself also formerly entertained doubts upon that point; but, from a careful investigation into the ingredients and manufacture of lithofracteur—for both composition and manipulation bear directly on this question—I am satisfied that mechanical separation is not to be feared. I was present at the Shrewsbury experiments, and discussed this point with Mr. Brown, of the Chemical Department, Woolwich Arsenal, and who expressed a very decided opinion upon the subject, to the effect that it was not mechanical separation that was to be feared in any of these compounds, but chemical change. Upon this latter point, however, my knowledge of lengthened storeage of both lithofracteur or dynamite under various conditions of light and darkness, cold and heat, leads me to believe that in this respect these substances are practically safe.

A few words on Mr. Horsley's letter, which follows. I may observe that Mr. Horsley deserves great credit for what he has done in developing the explosive powers of various substances in combination. His powder I know to possess enormous disruptive powers, for I have witnessed its effects. But Mr. Horsley is wrong when he says that there is not a pin to choose between lithofracteur and dynamite. The former compound consists of 75 per cent. of nitro-glycerine, and nearly 25 per cent. of other explosive materials, whilst the latter has 75 per cent. of nitro-glycerine, the remaining 25 per cent. being pure silica. I need hardly point out which of the two compounds represents the greater power. Mr. Horsley misquotes the *Times* description of lithofracteur when he makes it to say it is composed "principally of nitro-glycerine, with a dash of gun-cotton and gunpowder, with some earthy matter." What the *Times* report states is, that "the component parts consist of nitro-glycerine, gun-cotton, the constituents of gunpowder, infusorial earth, and one or two other substances."

It is to be regretted that such prohibitions exist against the general use of safe, yet violent explosive, compounds, for they are becoming more and more important in the interests of mining and quarrying. But it will be a matter much more to be regretted if when an opportunity offers for obtaining a relaxation of the more stringent laws affecting the present subject the inventors and proprietors of the various compounds should be found condemning each others wares, instead of making common cause together to obtain a comparatively free market. By the former course they will probably succeed in forging their fetters more firmly, but by the latter they will have a chance of successful competition. The best substance for the purpose will, of course, take the best position, and that point practical miners will soon settle when they have the opportunity. N.

May 25.

LITHOFRACTEUR.

SIR,—In the Supplement to the Journal of May 20 we find a letter, signed "Gun-Cotton," in which the writer appears desirous of obtaining information about some of the properties of lithofracteur, and in which he proposes that nitro-glycerine should be absorbed by gun-cotton to make, as he thinks, any separation impossible. We beg now to inform him that lithofracteur is so mixed (not infringing even upon Mr. Horsley's patent) that it forms a perfectly safe substance in use, transit, and storage, and that it cannot become liable to any self-separation. The comparatively small quantity of nitro-glycerine therein contained is so perfectly bound with a mineral neutral body that a separation from the mixture is simply impossible. The accident which your correspondent describes as happening to a professor of chemistry of experience can only have occurred through the glycerine not having been brought to the highest degree of nitration, or through its being carelessly handled when warm or at the time of its becoming crystallised. The proposition to use gun-cotton as absorbent to the nitro-glycerine is very genial; but the property alone of gun-cotton—in its being itself an explosive, and so easily exploded that by itself it must be so tenderly manipulated—causes many a consideration to arise before such a proposition can be carried out technically either in manufacture or use. In our method of manufacturing nitro-glycerine the glycerine is brought to the highest degree of nitration with the greatest safety when it possesses such a property that only the greatest incaution can produce an explosion.

As to the properties of lithofracteur compared with those of gunpowder, we need only add, in conclusion, that lithofracteur, being a soft, plastic substance, does not become scattered or dust, which causes all gunpowder to be so dangerous; that lithofracteur can be ignited without exploding, whilst powder does explode; and that lithofracteur does not explode through the whole mass by concussion or heavy blows, which by powder does take place even when quantities of it are at some distance from each other. After these explanations we consider it superfluous to answer the letter of Mr. Horsley. We thank you for the report of our experiments at Shrewsbury.—*Cologne, May* 24. GEBRUDER KREBS AND CO.

THE NEW PROCESS OF IRON-SMELTING.

THE FERRIE FURNACE.

SIR,—In the *Mining Journal* of May 27 your Scotch correspondent states that "some writers maintain that the saving of coal is entirely the result of the greater height of the furnace," and gives the following quotation, as purporting to come from one versant with the subject (?):—

"Have the Scotch ironmasters ever tried the high furnace without Mr. Ferrie's coking process? As regards the closed-mouthed furnaces not doing with raw coal it is all nonsense, as nearly all the Welsh furnaces are fed with raw coal, and they are mostly closed-mouthed furnaces, and the coal in the Wrexham district, in North Wales, is somewhat similar in quality to our coal in the Wishaw (soft) coal district."

The Scotch ironmasters, long before a furnace was built in the Cleveland district, tried furnaces both of increased height and capacity; and if your correspondent is at all acquainted with any of the larger ironworks in Scotland, such as Gartsherrie, &c., he will see furnaces in blast from 45 to 65 ft. in height, the greater number, however, being under 50 ft. The experience of the working of the 60 or 65 ft. furnaces has been that no improvement in the economy of fuel and no increase in the production of iron were thereby effected, and, as a consequence, the increased height "notion" was abandoned, or, if at all entertained by some, it seems not to have followed the "evolution process" which Darwin speaks of, for the progress in this direction appears to have been one of "arrested development," the number of 60-ft. furnaces having remained stationary for at least twenty years.

I believe the reason why the high furnaces in Scotland do not work satisfactorily, or at all events will not give better results than those obtained with less height, is the closeness of the column consequent upon the nature of the fuel used, so that, *per se*, increasing the height has been found only to increase the evil. Now, the Ferrie furnace must—and from the best practical consideration as an iron smelter which I have been able to give the subject—possess some peculiar and highly important advantage about it; for it is 83 ft. high, and the fuel used, so far as I have been able to observe, is the same as in other Scotch furnaces. The peculiarity, if I may be permitted to use the term, seems to me to be the novelty adopted by the patentee of dividing the column from the top some 30 feet down into four separate columns, thereby removing the greater pressure which must necessarily exist in a one-chamber furnace of that height. This seems a point which, if we are to believe truth at all, cannot for a moment be disputed, for Mr. James Hunter, of the Coltness Iron Company, an acknowledged practical smelter than whom I cannot advance a more reliable or trustworthy witness, writing on this furnace, states in a letter which was read at the last meeting of the Iron and Steel Institute, that "he had never in his experience seen a furnace work more steadily or satisfactorily than the Ferrie furnace." Referring further to your correspondent's quotation, "As regards the close-mouthed furnaces not doing with raw coal being all nonsense, as nearly all the Welsh furnaces are fed with raw coal." Now, this writer, either from inadvertency, want of knowledge, or some other less commendable feeling, states what is incorrect, and anyone labouring under such idiosyncrasies is surely not warranted to assume the position of a critic, especially on a subject involving so much experience and deliberation in its issue as this important question, neither of which he seems capable of controverting by either his facts or his arguments, and if your correspondent would have the goodness to refer to the columns of the *Glasgow Herald* a day or two subsequent to the appearance of the letter already quoted, he will find one or two practical questions of vital importance, which it would be interesting were he pleased to answer. In nearly all the Welsh furnaces coke is the fuel used, with occasionally, at some works, a small quantity of raw coal. At one or two of the Welsh works raw coal only is, doubtless, used, but the iron made would not be considered pig-iron in the Scotch market, and the coal so used is exceptional in quality, and quite dissimilar to "our coal in the Wishaw coal district." I am one of those who believe that iron can be made with raw coal in a close-mouthed furnace, but I do not believe that any fuel will be saved however high the furnace may be, and this—the saving of fuel—is surely the *sine qua non* to be kept in view; and to make No. 1 pig I fear a greater destruction of fuel will be found necessary. It appears to me that a furnace 83 ft. high, charged with raw coal, will work much in the following way:—The first 20 ft. from the hearth will be at a heat sufficient to reduce the ores, the next 20 ft. will be at a bright red-heat throughout and at this zone, free from hydro-carbon; the next 20 feet, the fuel will be nearly throughout in a soft pasty state, producing tar, and setting free moisture, &c.; and in the remaining 23 feet the fuel would be in a kind of stewing condition. If I am right in supposing the several zones to exist in the states described, there can be no saving of the fuel as compared with the quantity used in an ordinary 50 feet open top furnace, and I question if the gases would be of any value. I fear they would not be fit for combustion, but would pass off in a state of smoke. A No. 1 IRONMASTER.

FORMATION OF THE EARTH—METALLIC DEPOSITS, &c.

SIR,—I fear I am much intruding upon the valuable space in your Journal by again commenting on the above theme, under which Mr. Harris-James, M.E., replies to my letter in the Supplement to the Journal of the 20th of last month. First of all, I humbly beg to state that I am far from even venturing to concoct a new theory of the earth's formation, but only express the sincerest wish that others would not do so either, without possessing the necessary ingredients for it, which is—a thorough knowledge of the laws of nature, as taught by the science of physics. The term "physics" is not the "general signification of the science of nature (zoology, botany, magnetism, meteorology, mineralogy, geology, electricity)" &c., as Mr. Harris-James explains it. I am sorry to contradict him, but such general outlines of common knowledge ought to be well understood by everybody. Physics has to find out and discover the never-altering, invariable laws, which cause the variation in the system of the corporeal creation. Physics arrives at the comprehension and knowledge of these laws and causes partly, only through experience, by way of carefully executed and very precise experiments and observations; but as an old proverb says—"Pondere, mensura et numero Deus omnia fecit," advises the student of nature to measure and weigh, and then to find out the relations of the respective quantities, and, therefore, only to proceed with the aid of mathematics.

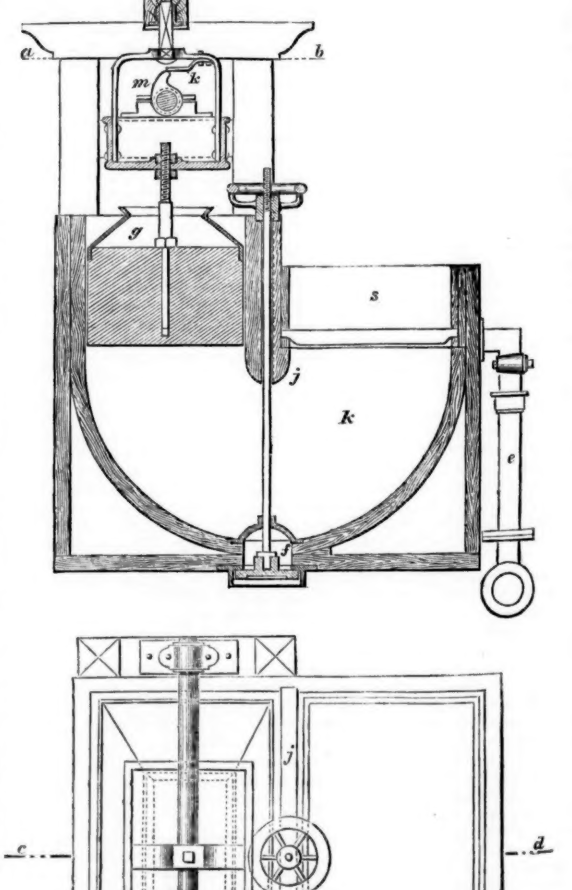
Contrary to physics, zoology, botany, and mineralogy, are essentially *descriptive* sciences, although they are based upon a previous knowledge of physics, without which the study of nature is but a snare. But how physics can "comprise descriptive theology," as Mr. Harris-James suggests, is a complete mystery to me, and may, perhaps, best be explained by himself. The acquaintance with even only the principles of physics would make such names and definitions impossible, which Mr. Harris-James uses in his letter of May 13, as, for instance, "an electric vein" and a "metallic gas!"

Squire's Mount, Hampstead. C. L. GRIESBACH.

ORE DRESSING—No. VII.

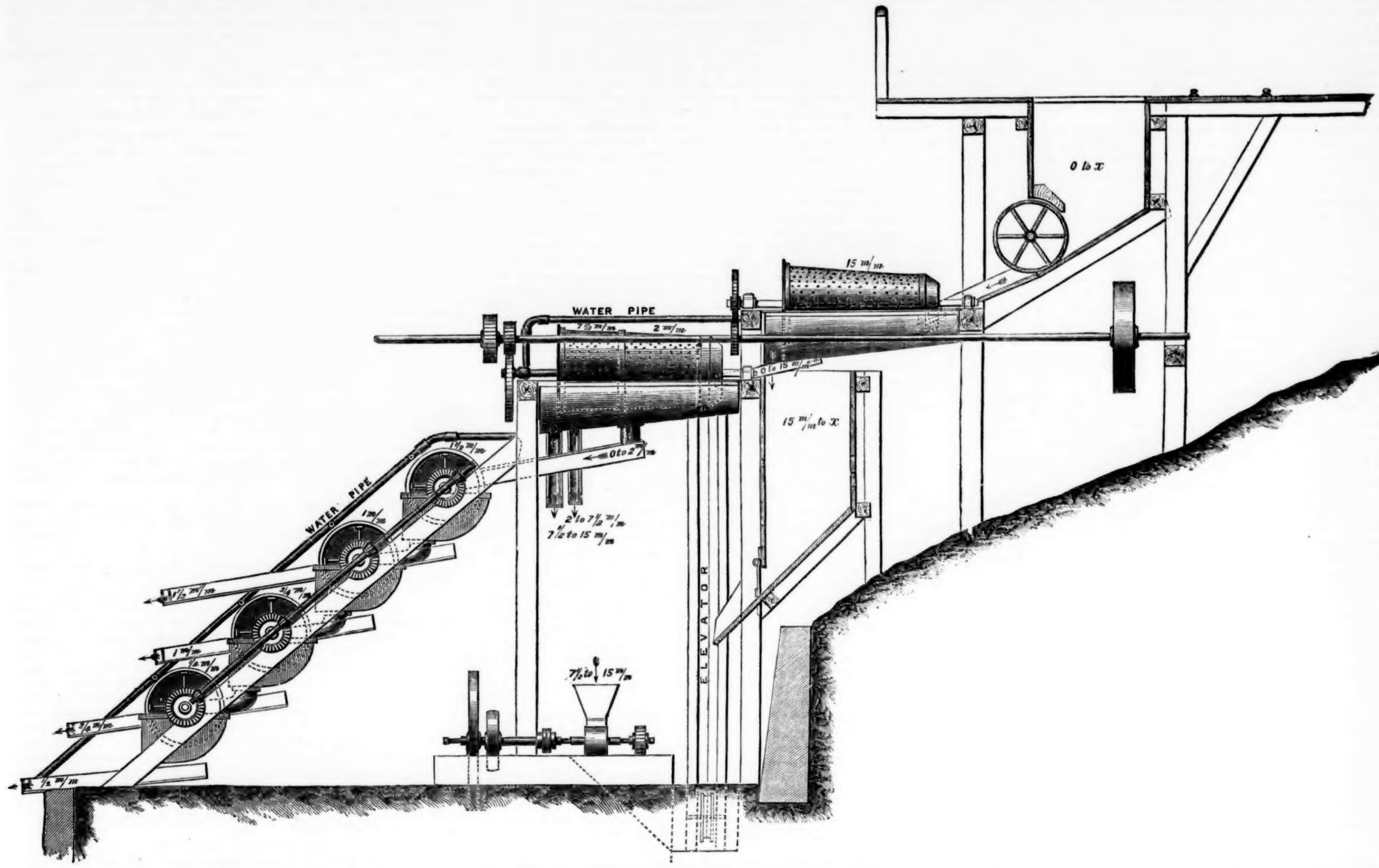
SIR,—The next improvement in jigging consisted in suspending the sieve over the tub or tank, and agitating it in the water by means of a long handle or lever. With this improvement it became possible to greatly increase the amount of work that each machine could get through, by making the sieves much larger than in the old ones. The form of the apparatus was also changed from the old round tub to the present rectangular tank. These tanks are generally made about 3 ft. 6 in. long, and 3 ft. broad, the sieve being about 3 ft. by 2 feet. The motion was generally given by a boy, who, by springing up and down at the end of the lever, imparted the necessary movement to the sieve. This motion must not be a uniform up-and-down movement, but must consist of a quick and sudden downward stroke, while the upward stroke may be much slower. After a sufficient number of strokes had been given the sieve is raised from the water. The operator then proceeds, with an iron scraper, to remove the upper portion of the bed, which consists of all the lighter particles of ore and gangue, technically called tailings. The thickness of the first layer depends a great deal upon the quality and value of the ore, and varies in every dressing establishment. Generally a second layer is then removed, which is jigged over a second time, under the name of middlings, while the bottom part of the bed consists of the clean and concentrated ore. In these jigs the mesh of the sieve-screen must naturally be much smaller than the size of the grains to be treated. The old Hartz jigs differed from these only in that the screen was of a larger mesh than the stuff to be treated, which was, therefore, supported on a permanent bed, formed of larger grains of the densest ore to be treated. This arrangement allowed the richer portion of the ore to pass through the bed and sieve, and be deposited in the tank below, while the lighter and poorer stuff was scraped off the top, as in the English jigs. Both these kinds of jigs are still very much in use in small mines, and are worked by hand or machinery.

The first great step towards the improvement of jigging machinery was made in 1831, by Mr. Petherick, the superintendent of the Fowey Consols. His invention consisted in making the sieves stationary, and imparting the up-and-down motion to the water by means of a plunger or piston suspended below the screen. As this was found, after some experience, to have many deficiences, owing to the fine stuff falling on to and clogging up the plunger, Mr. Petherick placed the piston in an adjoining tank, which communicated with the jig at the bottom. This appliance has in principle continued to the present day, and is the essential part of all our modern jigs. The original Petherick jig was of a circular form, with the plunger in the centre, and the screens, of which there were several, were placed round the circumference. In this manner one plunger was made to work eight jigs at once. Later on the same gentleman applied elastic diaphragms to the side of the jig-tanks, instead of plungers, which diaphragms were put in motion by a cam. This system has been used a good deal, especially in America, but I do not know that it has any particular advantage over the plunger, and it has the disadvantage of being rather more expensive of construction, and requiring a much greater power to work it than the ordinary jigs. The adjoining sketch represents a plan and section of the most simple form of



the old plunger-jig, and the one most generally in use up to about 1860, some of which may still be seen at most of the European dressing-floors. It has been variously made of wood or iron, according

ON THE DRESSING OF ORES*—NEW ARRANGEMENT OF SIZING TROMMELS.



to the cheapness of one or other article. For myself, I generally prefer wood in all dressing machinery, owing to the facility with which each machine can be made at the mines, and repairs effected without employing very skilled labour. The jig consists of a single box or tank, *h*, the upper portion of which is divided into two compartments by the partition-board, *j*. The inside lining of the box is made either circular, as in the drawing, or slanting down to the valve, *f*, so that all the fine stuff may be carried away with the water, and not clog up in the corners as it otherwise might do. The plunger, *g*, is made heavy enough to descend with its own weight immediately that the cam, *m*, ceases to act on the catch, *k*. The length of the stroke was adjusted by the screw, *n*. In a great many cases an India-rubber spring or buffer was introduced above the cam, instead of the ordinary catch arrangement, and it was the expansion and contraction of this spring which imparted the required motion to the plunger. The great objection to these springs was that they were very apt to get hard and stiff in winter or after a prolonged use. Both these jigs had the common objections of causing a most tremendous rattle and noise, and of wearing out very quickly all the moving parts—a natural result from such a motion. The manner of working was precisely the same as in the old hand-jigs, and was adapted to either the English or Hartz systems. A charge of ore was laid on the sieve, *s*, and the water introduced through the pipe, *e*, till it rose about 2 in. above the charge; the plunger was set in motion at a speed averaging from 50 to 60 revolutions per minute for about 10 or 12 minutes. It was then stopped, the water let off through the valve, *f*, till the bed was left free, and the different layers were then removed, as in the old process. These jigs, running at a speed of 50 revolutions per minute, would put through about 5 cubic metres of stuff from the crushers in a day of 12 hours. One man could always attend to two machines. In 1861, Mr. Kley, of Bonn, the consulting engineer of the Vieille Montagne Company's Mines, invented the slide motion for jigs, which is now so universally in use all through the continent of Europe. This simple contrivance, which I shall have occasion to explain by drawing in a future letter, at once did away with all objections of wear and noise common to the old jigs, and, at the same time, greatly simplified the construction of the plunger, and diminished the amount of power necessary for driving them. It allows, also, of a most accurate arrangement both for adjusting the length of stroke, and also the proportionate speeds of the up-and-down strokes.—*New York, May* 17. E. G. SPILSBURY.

ON THE DRESSING OF ORES*—No. VII.

SIZING APPARATUS.—In setting out a dressing-floor, the suitability of one form of trommel sieve over another will depend on the sectional line of the ground, and arrangements necessary for treating the vein-stuff. When the surface is flat, continuous, or continuous double trommels, will effect the sizing of the products within the shortest line of fall; but where height is available, a set of single conical trommels may be advantageously employed.

The disposition of the trommel-sieves will also be consequent on a variety of economic considerations. In one locality, where labour is cheap, the ore friable, and of great value, the picking operation may extend to stuff as low in size as 10 or 12 millimetres; whilst in another place, where labour happens to be scarce, and the ore freely intermixed with gangue, 50-millimetre stuff may be properly sent to the crushing-mill. At the Meinerzhagner Mines, Prussia, plumbiferous sandstone is drawn to the top of a tower, 100 feet in height, tipped into hoppers, and passed through the holes of washing-plates, whence it descends almost vertically from separating, dividing, and sizing trommels, into crushing-mills and jiggers. At other mines, where continuous cylindrical trommels are in use, one part of a trommel is sometimes set apart for dividing the stuff, so that it may be sized in a side, or parallel, trommel. In this way five or six divisions of stuff may readily be obtained for coarse and fine sand jiggers.

The illustration (at the top of this page) shows a trommel arrangement which I had occasion to design some time ago for sizing sand associated with clay the various particles having but little differences in their densities.

The initial stuff, varying in size from *o* to *x*, is delivered to a separating trommel by means of a wheel, and is divided into two main portions, one, in which the grains range from 0 to 15 millimetres, the other, containing pieces of clay and earthy substances, from 15 millimetres to *x*. The latter division falls into a hopper, from whence it is taken to the waste heap, while the sand, composed of sizes from 0 to 15 millimetres, is passed into a second dividing trommel, parted into three classes, and disposed of as follows:—Sand, 0 to 2 millimetres, to the step-sizing trommels; coarse sand, 2 to 7½ millimetres, to a second set of step trommels not shown in the figure; and rough stuff, 7½ to 15 millimetres, to a crusher. The fine sand is in turn divided by the sizing trommels into grains of ½, ¾, 1, and 1½ millimetre, whilst that portion ranging from 0 to ½ millimetre, is subdivided by a classifier into three sorts of meal sand, ⅙, ⅓, and ½ millimetre size. The crushed stuff is returned to the dividing trommel by an elevator. Coarse sand, 3, 5, and 7½ millimetres, is jigged, as also the fine sand running from ⅙ to 2 millimetres. The meal sand, from 0 to ⅙ millimetre, is subject to a further classification, after which the resulting sizes are concentrated on a system of inexpensive and almost self-acting sleeping-tables. The illustration shows the water distributing pipes, wrought-iron hoppers under the trommels, the mode of delivering the stuff from one trommel to another, and the gearing for driving the step, dividing, and separating trommels. The speed of the step trommels is 20 revolutions per minute, and the quantity of distributing water supplied to each trommel, 3 gallons per minute.

The following table contains particulars relating to speed, dimensions, and sizing lengths of continuous trommels in work at various mines:—

Name of mine.	Diam. of trommel in inches.	Revolutions per minute.	Length of each sizing porton of trommel in inches.	Length of trommel in feet.	Diam. of hole in each length of trommel in millimetres.
Berzelius	32	14	48, 36, 24, 14	10	¾, 1, 2, 3
,, ...	32	14	30, 26, 18, 16	7½	4, 6, 8, 10
Altgluck	36	12	40, 30, 27, 21, 17	11¼	4, 6, 9, 12, 16
,, ...	36	12	37, 38, 36, 32	12	¾, 1, 2, 3
,, ...	36	12	33, 22, 20, 13, 13	9	¾, 1, 2, 3, 4
Lohmansfeld	24	30	24, 24, 24, 24	8	20, 15, 10, 5
,, ...	24	30	24, 24, 24, 24	8	15, 10, 5, 3
,, ...	12	—	24, 24, 24	6	1, 2, 3
Wildberg	22	20	30, 30, 30	7½	1¼, 2, 3¼
,, ...	24	20	30, 30	5	½, ¾
Iserlohn	36	12	38, 22, 28, 24, 19	11¾	6, 7½, 10, 13, 18
,, ...	36	10	34, 29, 35, 21, 18	10½	½, ¾, 1¼, 2, 3¼
	Conical				
Burra Burra	12	30·48	21, 24, 27, 30, 36	11½	18, 13, 10, 7½, 6
,, ...	12	30·48	23, 27, 29, 34, 48	13½	3¼, 2, 1¼, ¾, ½
Meinerzhagner...	9	32·48	36, 36, 30, 18	10	6, 6, 10, 18
,, ...	14	30·41	30, 33	5½	1, 1
,, ...	12	30·48	54, 42, 36	11	7, 8, 9
,, ...	12	30·48	42, 36, 36, 36	12½	4, 6, 8, 10
,, ...	12	30·42	39, 39	6½	3, 2

It cannot be urged too strongly that a good classification, suitable to the nature and composition of the mineral, is a primary condition for obtaining a rapid and effective separation of the ore. But with this remark it should also be remembered that for practical purposes the division of stuff extends to certain limits within which subdivision will but entail profitless labour. Separation in the jigging-machines may often be effected when the relative proportions between particles of two successive classes are within the limits of 1 to 5, but in setting out trommels it will be safer to take for the sizes a somewhat closer relation, and to make the diameter of the holes in each sizing cylinder about one-third less than the diameter of the holes contained in the preceding trommel. JOHN DARLINGTON.

Coleman-street-buildings.

NEW HIGH-FALL STAMPS.

SIR,—I have read the letter of Mr. Mufford, of St. Ewe, published in the Supplement to last week's *Mining Journal*, and think your readers may complain that it pretends to give information which is really not given, in order to prejudice an invention described in a previous number of the Journal. Mr. Mufford states that a new stamps has been designed by Mr. Samuel Searle, of Sticker, by which he can give 60 blows per head per minute, with a fall for the head twice that of ordinary stamps—that is, with the same power he can give 60 blows with 20-in. fall instead of the same number of blows with 9-in. or 10-in. fall, but Mr. Mufford does not state that to do this he has had to adopt the invention described in the Journal of April 22 and May 20, nor does he explain wherein the difference is to be found. If Mr. Searle has had 14 years' experience in constructing stamps, it is curious that he should never have thought of a high-fall stamp until the articles alluded to were published in the Journal.

As we have had no mechanical description of Mr. Searle's (?) stamps, it is of course impossible to say with certainty that their adoption would inevitably lead to litigation with the proprietor of the patent protecting the invention described in the Journal of April 22, but every mine manager will naturally draw his own inference, and at least endeavour to avoid becoming involved in a lawsuit. It is such inventions as are mere colourable imitations of others, designed with no other object than that of avoiding the payment of royalty to the real inventors, that have created such a general desire among even those who recognise the value of invention to the community, and would readily remunerate real inventors to procure the abolition of patents altogether, and I am really beginning to think that it is copyists alone who benefit by patents, and that, therefore, the sooner they are abolished the better.

As a new high-fall stamp was described in the Journal of one week, and in the following week Mr. Mumford refers to what at least appears to be an identical invention, although attributed to another inventor, I think, therefore, it is but fair to the readers of the Journal to ask Mr. Mumford for the mechanical details of the invention he refers to, in order to relieve Mr. Searle from the charge of plagiarism.

Cross-lane, June 1. E. C.

MINING PROGRESS—BORING MACHINERY, &c.

SIR,—It cannot but be noticed that very many inventions aiming at lessening the severe and slow labour entailed on the metallic miner in his progress through the rock in which the ores of the metals in which he is in search of are embedded have been abundant of late years. Although these, however, have in many cases been ingenious attempts to supersede the drill wrought by manual labour, there has been some defect attending on their practical working that has hitherto been fatal to their common use. It must be allowed that mining proper has only very slightly been benefited by the inventive labours that have led to the advancement of almost every other mechanical calling, and that there is ample scope for reform in the primitive and, consequently, laborious methods now in vogue. There are, however, impediments to the use of boring machinery inherent in the mode of working, and which are of such moment that machines, or combinations of these, must be produced with special regard to these details, and to the neglect of which, by mechanicians ignorant of underground necessities, must be ascribed the working failure of their seemingly, when tried on surface, suitable machines. The limited area of the galleries prevailing in metallic mines, the almost vertical position of the lodes containing the ores which are the object of search, and the ever-shifting position of the miner, vertically and laterally, must, I think, ever present grave difficulties to the introduction of boring machinery.

The generation and distribution of the motive-power necessary to the working of an extensive mine, though expensive, would be the least of the difficulties. With few exceptions, the levels of existing mines are small. In old mines it would entail great expense in stripping down the rock so as to make room for pipes to convey the working power to each end, and be a constant charge and loss of time, adding to the piping as the levels progressed. Again, much time would be lost in fixing prior to, and removing the machine drill after, getting the holes bored, even if in separate, easily-handled pieces. If mounted on tramway, the stuff broken would always required to be removed ere the machine could be fixed for a fresh charge. In rising and stoping especially, those conversant with mining details are aware of the almost insuperable determents, and even in sinking there would unquestionably be annoying hindrances, which, in the aggregate, would go far to equalise the time saved in the actual drilling of the holes. Drilling machines may possibly be economical and useful in the new levels of mines, which have reached and are attaining great depth in hard ground, where the rapidly-increasing temperature, so enervating to manual labour and destructive to life, would seem to offer the most likely successful field to their use. It may be presumed that compressed air, the most suitable motor, could be readily supplied from appliances connected with the pump-rods at the entrance to the different galleries, without sensibly increasing the work of the water-engine. I confess that, taking the most sanguine view of the results that have been achieved, the sum of the diverse obstacles to the economical substitution of drills driven by steam, compressed air, or any other motor, is so great that I am inclined to think that concentrated efforts in this direction to aid the metallic miner will only be so much time and money lost.

The bedded, almost horizontal position of coal, the generally large working area presented, and the fact that in itself the possibility of extracting this mineral without blasting is a desirable object, render it likely that the coal-getting machines lately introduced will come into more extensive use, the rapidity and extent of which will depend wholly on the degree of superiority attained over hand labour, and their practicable adaptation to varying thickness of mineral. No doubt, like all other machines, practice will show defects, and suggest improvements which will render them more efficient; so that, if I am right in assuming that there is a decided advantage in their use now, their future almost general adoption in coal mines is a certainty. Returning to metallic mines, the more especial subject of our remarks, I am of opinion that we must look to the chemist for aid to expedite the progress of the miner. Simplicity in method,

and readiness in application, are imperative to the successful introduction of any agent to accelerate exploitation of ground; the circumscribed area in which the miner works must continue, because there is no motive in excavating more ground than will allow of the taking away of the full width of the lode, in most cases about the breadth necessary to allow of suitable tramway and wagon. The *modus operandi* preparatory to blasting the rock must be as before; but I consider that the to be looked for aid is not so much the doing away with the labour of drilling as in the use of a more powerful explosive agent, which will also lessen materially the time and labour of boring.

In nitro-glycerine we have an explosive mixture that, freed from the noxious effluvia injurious to sight and respiration attendant on its combustion, and more particularly its instability, even when pure, is specially adapted to the peculiar requirements of the metallic miner; bore holes as small as the drills would stand would suffice to give an explosive power greatly in excess of the present system, the charging of the blast would both be simple and rapid, and not the least of its advantages is, that while accelerating present progress at least one-third, of course effecting a like saving in the expenditure of time and money, there is no embarrassing intricacy or novelty involved, the miner would readily adapt himself to a procedure simpler and much safer to charge than powder or gun-cotton. Looking at what science has achieved, it is surely reasonable to believe that the blasting oil only requires to engage the attention of our practical chemists to have its dangerous decomposing nature counteracted, and that through their labours the miner will shortly be in possession of such a mighty helper, freed from its uncertain and deleterious ingredients.

The columns of the *Mining Journal* are even now recording progress in this direction. Of course, great caution must be exercised in crediting the glowing statements of patentees until their assertions are borne out by conclusive practical experience, but it may safely be affirmed that real efficiency will speedily be recognised and prized by mineowners. And with reference to the operative miner, may we not say, in view of any improved mode of working, that fifty years' experience in numerous industrial undertakings will not be without its fruit, as manifested in the exploded, fallacious, and narrow-minded views that, boding present ill, could not discern the increased demand that follows enlarged production, invariably leading to increased wages for work'eased from its severest toil. Increased acceleration implies increased development and production, and correlative of that diminished risk, the bare statement of these plain truths is at once significant of their influence on the future output of mines, which realised must effect a sensible change in the value of metals. On the other hand, counteracting the tendency of the metals simply bearing the proportionate rate existing now, many obvious, and some unthought of, applications in the arts and manufactures would, as the price decreased, set in with geometrical rapidity, ensuring the benefit of the improved mode of working to the mining interest.

Caldbeck, May 31. CUMBRIAN.

OUR COMMERCIAL WEALTH—THE BANKING INTERESTS.—No. II.

SIR,—The "Issue Department" of the Bank of England shows a "note" creation of 38,793,505*l.*, against which it possesses a Government debt of 11,015,100*l.*, and other securities 3,984,900*l.*—(say) together 15,000,000*l.*—the balance being gold, silver coin, and bullion, amounting to the enormous sum of 23,793,505*l.*

The Banking Department has received from the Issue Department 38,793,505*l.*, of which it has circulated to the public 23,940,985*l.*; the Bank "post bills" in existence amount to 512,792*l.*, which is covered by gold and silver coin in the tills, 754,204*l.*, thus leaving a surplus of 241,412*l.*; this, added to the aforesaid 23,940,985*l.*, shows that the Bank has now sufficient gold and silver to pay every note it has circulated, with 93,932*l.* over and above its whole liabilities.

In the next place we will refer to its banking position, and it is scarcely possible for a commercial institution to show more strength and power, and yet to transact profitable business. We commence our observations by introducing the subjoined figures—

CR.—By balance of gold and silver over notes and bank post bills in circulation			£ 93,932
By Government Securities in hand	£12,958,741		
Less Public Deposits, including Exchequer, Savings' Banks, Commissioner National Debt, and dividend accounts due	8,989,026=		3,969,615
Other securities in hand			17,102,789
Proprietors' capital	£14,553,000		
Ditto rest	3,134,653=		17,687,653
Total			£38,853,989
DR.—To deposits, bankers, merchants, brokers, and general customers' securities			18,478,783
By surplus in hand over commitments			£20,375,206

ADDENDA.

CR.—By surplus balance in hand over commitments			£20,375,203
DR.—To proprietors' capital		£14,553,000	
Rest not capitalised	£3,134,653		
Undivided gains	2,687,553=	5,822,206=	20,375,206
Balance of undivided gains accumulated		£2,687,553	

The bank is remarkably free from risks in its engagements. The dealings with the Government are covered by cash in hand of 8,989,026*l.*, against 12,958,741*l.* advances. The bank receives interest on the latter sum, and pay none on the former. The advances to the general public, and bills discounted, amount only to 17,102,789*l.*; on the contrary, the banks throughout the kingdom, the mercantile public and others, have deposited with the bank the sum of 18,478,783*l.*, for which they receive no interest. Again, the capital is secured beyond a doubt of risk, with a surplus "rest," uncapitalised, of 3,134,653*l.*, and undivided gains to date amounting to the further sum of 2,687,553*l.*; in fact, the bank has its capital intact, an additional accumulated fund of 5,822,206*l.*, with 18,478,783*l.* belonging to bankers, merchants, and others—say, together 24,300,989*l.*, out of which it is liberal enough to advance the Government 3,969,615*l.*, and to deal with the general public to the extent of 17,102,789*l.* only.

What shall we do with our surplus money? The largest accumulation of bullion ever known is now piled up in the Bank of England, and a continued falling off in the banks loan and discount business is discernible. The demand for money is slight in every quarter, and the disposition to embark into home enterprises still dormant. The price of iron is firm at present quotations, and the export business active, while the demand for this particular metal is likely to advance. This, however, is only one branch of the home industries of the mother country. The tin mines of Cornwall pay exceeding well, yet the dealings in them are few, and of rare occurrence, when compared with the regular and substantial dividends declared. There is a demand for mines, especially foreign, which clearly shows that this class of property is gaining increased attention from the general public, and probably the mines of Nevada will become popular favourites. Yet mines will absorb to a trifling extent only the vast accumulated wealth at present hoarded. In foreign loans a large sum has already been expended, and still more will be required and applied for—are we safe in lending? Turkey, Egypt, Italy, and lastly unhappy France, will appeal to our sympathy, and endeavour to partake of the wealth not only existing, but still flowing into our already well-lined coffers. Telegraphy is apparently at a stand still. Railways, though progressive, are severely watched, and no great amount of money can be directed in that quarter without infringing upon the reforms and retrenchments insisted upon, at and after the exposees of 1866, 1867, 1868, and 1869. London and provincial joint-stock banks can scarcely become extended, for even the London and Westminster, with a guarantee of 50 per cent. in hand on the capital, paid up at 20*l.* per share, sells only at 125 per cent. premium, say, 275*l.* for every 150*l.* paid up—100*l.* capitalised and 50*l.* guarantee fund. This may appear momentous to the investor—yet one about to embark must remember that this bank is involved in over 20,000,000*l.* of financial dealings with the public, having only a capital and rest of 3,000,000*l.* to protect it from the risks and hazards of commitments, and those buying shares at 125*l.* prem., on 150*l.* paid and 100*l.* only, receiving dividends, with 400*l.* "uncalled," are simply embarking in a trading concern. This institution, and the others referred to in my last letter, will establish the difference between the Bank of England and every other joint-stock bank throughout the length and breadth of England. In the next position allow us to remark that miscellaneous securities, such as Indian railways, foreign stocks, and colonial with foreign railways, loans on Government guarantees, and preferences, are decidedly "negative" rather than "progressive" mediums of investments. It is true that the Mother Country received the interest, still the principal revenue—employment and properties—are in the possession of the foreigner. Let us, therefore, hope that the domestic troubles and disasters now existing and occurring in France may teach us a lesson of wise utility and prospective discretion—to keep that which we possess at home, and to direct our vastly-increased wealth to the development of home industries, and the extension of our trade and commerce with Europe and the marts of the world.

The commitments of the London and Westminster, London and County, London Joint-Stock, and Union of London Banks, amount to 57,790,072*l.* at their last bi-annual audits. The paid-up capital of these four companies amounts to 4,200,000*l.*, with an aggregate guarantee fund of 2,434,540*l.* The latter amount is about 58 per cent. of the capital funded, still the public have no knowledge of the amount of commitments existing in a stage of chronic abeyance —*i.e.*, matured and not redeemed; that is to say, estimated amongst the assets and not proved of value. To meet this ever-growing grievance the guarantee fund is equal to 4 1-10ths per cent. on the commitments. The statements of accounts, half-yearly audited, and circulated amongst the proprietary, make no reference to those commitments matured and not redeemed, yet in well-informed circles it is generally accredited that fully 30 per cent. of the business of joint-stock banks is in a state of negative "*transition.*" In contradistinction to joint-stock banks, pray allow us to refer to the following eight English mines, upon which the sum of 11,684*l.* only has been expended, whilst the dividends have amounted to 3,139,601*l.*:—

	Outlay.	Dividend.
Devon Great Consols	£1024 0 0	£1,176,601 0 0
Phœnix	2500 0 0	231,750 0 0
Basset	2640 0 0	333,840 0 0
Buller	1280 0 0	300,000 0 0
Tresavean	3200 0 0	434,500 0 0
South Caradon	640 0 0	339,200 0 0
North Basset	*Nil*	150,000 0 0
Levant	400 0 0	173,710 0 0
Total	£11,684 0 0	£3,139,601 0 0

The above are only a fair type of successful Cornish mining. Amongst other instances we may refer to Consols, Gorland, Damsel, St. Day United, Virgin, and Clifford in Gwennap, Carn Brea, Tincroft, Cook's Kitchen, Dolcoath, and the Roskears and Croftys in Camborne and Illogan, the Alfreds in St. Erth and Phillack, and onwards to the Marazion district, with the mines of Breage and Towadnack, which together have yielded gains of 10,000,000*l.* sterling upon less than 500,000*l.* outlay. It is true that mining facinates more than it deters, yet such substantial gains can scarcely be shown in any other branch of our national industries, and it is due to legitimate mining to assert that, next to agriculture, it takes the second position in regard to revenue, gains, and employment of all our domestic resources.

The success attending tin mining in Cornwall is now attracting unusual attention, and deservedly so, as the gains are beyond those of even the richest silver and gold mines of Nevada and Mexico. The late Capt. Charles Thomas observed in respect to Dolcoath Mine, about 15 years ago, that the price of tin would regulate the amount of dividends paid by that company; in fact, over 55*l.* per ton the cost of yield would be the surplus profit to the adventurers. The advances in value of this metal (30*l.* to 35*l.* per ton) has rendered Dolcoath the richest mine in Cornwall. Tincroft, on the same lodes, is an old mine revived, and positively sells at 50*l.* per (9*l.* paid) share.

As an instance of vital resuscitation upon resources of ground laid open in search of copper, which from enhanced value of tin subsequently proved of value to the proprietary, it is of importance to draw attention to the above two mines.

In connection with Cornish mining industry, Mr. Thomas Spargo, of Gresham House, has afforded to the enquiring investor unusual sources of information, both as regards statistics and practical geological sections of the various recognised mineral veins in Cornwall, Devon, and even into Wales, and we are pleased to record that that gentleman has secured the leases of the Harmony and Montague Mines, situate in Redruth, Cornwall. The united property now consists of only 64 shares, which have been issued at 65*l.* to 70*l.* each. The extent of the levels open in search of copper render this mine all but a *compeer* to Dolcoath and Tincroft. We are much mistaken if upon the practical working of the properties the results established do not equal the best and most valuable ones in the West of Cornwall. It should be remembered that the Harmony and Montague possess thousands of fathoms of ground laid open in search of copper that can now be wrought at profits for tin, and without the costs of development. In fact, the proprietary possess a mine that is in itself, similar with Dolcoath and Tincroft, "a doubly valuable one as a tin instead of a copper-producing investment," the expense of opening upon the various copper lodes having laid open a tin-producing mine without the expenses of sinking and driving levels. This is easily understood by all practical authorities. In comparison with Van, West Chiverton, and other recent celebrities, the Harmony and Montague will prove a prize of unusual importance.

Crown-court, Threadneedle-street, London. R. TREDINNICK.

MINING IN BRAZIL—THE INVESTIGATION.

SIR,—Regarding the letters criticising Brazilian mining, calling especial attention to Taquaril, and the management of those companies wherein the shareholders determined to make a full investigation, naming Mr. Gordon for this most important trust, allow me, with all due deference to Mr. Gordon, to state that although he may be a most honourable and talented gentleman, and that for his position, perhaps, no one more fit ever represented the Morro Velho Company, that his proceedings with Capt. Treloar render his nomination, under circumstances past, subject to disapproval, considering they have been connected; and that in nominating a person for this may be a complicated and trying question—a question, probably, of annoyance, dissatisfaction, and loss of time: every object must be balanced to meet justice by unbiassed and disinterested opinion.

Capt. Thomas Bawden—a man charitable and just, commanding extensive experience and knowledge, the vendor of the Don Pedro, over 35 years in that locality, a man of independent property and action, one whose word will not be gainsaid—is the most desirable to appoint. He can give direct information of all the purchases and other transactions; and as reports are that properties have not cost anything like the money paid, it is well to know where the money has gone, and to investigate mine and surface cost; in fact, all past and present means to remedy, if possible, our future, and if Captain Thomas Bawden cannot put us in the right way, there is no man that can substitute him. To send out comparative strangers is merely a matter of ridicule, especially when dependent on the hospitality of the representative. The origin of these companies arose from a dispute between Mr. Gordon and Capt. Thomas Treloar, when working together at cross purposes at Morro Velho; therefore I repeat that those in power must pause before making this appointment.

The future of Brazil—at least of Minas Geraes—depends upon the result of the investigation, and urges the necessity of the person employed possessing both mining experience and local knowledge, able to enter into cause and result of the past, and ensure future confidence for a should-be rich and prosperous mining district, unfortunately now sinking, and without change must be lost to English capital and enterprise, at least for this generation. What mania is it that calls for a vicinity like this to be under the sole power and control of an individual; or with the exception of Capt. William Treloar and his antecedents (Sao Vicente, for instance, an introduction to Brocatus), nothing has been credited, and old and abandoned mines reported on *pro* and *con.*, have consumed our capital, excepting the Don Pedro. In mentioning this property I may say, as concerns the pump-work, it is even doubtful whether this expense can be justified, looking at the resources at hand—wood and iron to any amount, let alone the theory of the great authority which I dispute. Jacotinga, according to my observation, never reached beyond the river bed, or at most 40 to 50 fathoms below the surface, and is always accompanying the range serra in body, curving and dipping accordingly. Lines run zigzag, arborescing, opening, and closing in veins and bunches from the matrix, believed to prefer an easterly direction; but this is not necessarily so, as I have seen them in exactly the contrary direction.

The Pitangue purchase I hold as a good investment. It is in the same run as Maquine, the body of formation appearing at Antonio Pereira, a known rich auriferous lode. It works on to the Carassa, in the opposite direction under the Itacolemnia. The whole locality is worthy of speculation. Several rich large stone lodes also exist, besides the river work, and it is a pity, should it be proved that large sums have been squandered in the purchase, and followed by extravagant surface cost, that Brazilian mining should be abandoned.

FROM ONE WHO KNOWS A LITTLE OF BRAZIL.

THE METALS AND THEIR ORES—GOLD—No. XVIII.

SIR,—In the present paper I purpose, as briefly and in language as free from technicalities as possible, describing such methods of testing for the presence of gold as may be readily applied with some degree of exactitude by the miner in his explorations for this metal, in remote regions probably, and under circumstances which would utterly preclude the application of the more exact and refined tests found in the chemist's laboratory. Certain minerals are met with in metalliferous districts, in which gold is also found, which to the uninstructed eye resemble that metal so closely that, unless provided with suitable means of detection, a person is very liable to be misled when trusting to the unassisted vision alone, hence the necessity of having other and more reliable adjuncts to aid us in arriving at accurate results. Amongst such substances may be mentioned iron and copper pyrites, native copper, and mica, whilst in certain notorious gold diggings splendid artificial electroplated "Brummagem" nuggets, and even brass filings, have before now been "found," and actually sold and bought as genuine gold. In analytical investigations two methods are generally employed—the wet analysis and the dry assay—the one being confirmatory of the other. By the wet method chemicals in their fluid form are used, whilst in the dry way fire is employed, the requisite temperature (in the absence of a furnace) being most conveniently produced by means of the mouth blowpipe, an instrument which will be subsequently fully described in these papers, and with the use of which every miner should make himself familiar.

The apparatus and chemicals requisite for the purposes in view need not be either costly or bulky, consisting chiefly of a few test-tubes, or round tubes closed at one end, made of thin hard glass to withstand the sudden application of heat, and varying in size from 3 to 7 in. in length by ½ to ¾ in. diameter. A few pieces of glass tubing of various sizes, some small glass funnels, on which to support filter papers of thin white blotting-paper, a spirit lamp, some small iron spoons, a couple of medium sized Berlin crucibles, evaporating dishes, and watch-glasses—upon a pinch the bowl of a tobacco pipe with the hole stopped, and a common saucer will supply the place of crucibles and evaporating dishes—a blacksmith's blowpipe, a piece of well-burnt charcoal, two or three pieces of platinum wire, each about 4 in. long, a piece of platinum foil 3 in. by 1 in., to be used as supports for blowpipe, some bone ashes for cupels, a small steel anvil and hammer, a lens, a small magnet, a small balance and grain weights for taking specific gravities, &c. Neither is it requisite that the variety of chemicals should be numerous. A small supply (say, an ounce each) of carbonate of soda, borax, microcosmic salt, nitrate of potash, and a solution of nitrate of cobalt will serve for blowpipe fluxes and re-agents; three stoppered bottles containing nitric, hydrochloric, and sulphuric acids will be necessary. The most important chemical tests will be mentioned when the metal immediately under discussion is treated upon.

Those sufficing for gold are *protochloride of tin*, prepared by dissolving tin to saturation in hydrochloric acid, and *protosulphate of iron* (green vitriol), which may be prepared by dissolving a few small nails in dilute sulphuric acid, and crystallising. It has been already stated in these papers that gold is always found native, and that it is a yellow, malleable, ductile metal, softer than copper, but harder than silver, about nineteen times heavier than water, not altered by heat, nor acted upon by air, moisture, or any single acid, but dissolved by aqua regia, which is a mixture of two parts of hydrochloric acid, and one part of nitric acid. Now, bearing in mind our knowledge of these facts, supposing we find in our explorations a substance resembling gold in appearance, how can we best ascertain whether we have the precious metal before us or not? We first place a fragment of the substance on the anvil, and if it flattens under a few smart blows from the hammer it possesses one of the characteristic qualities of gold—namely, malleability; but then we must remember that copper is likewise malleable and ductile. If it is brittle, and falls to pieces under treatment, it is most certainly not gold, but may be iron pyrites, or copper pyrites. To satisfy ourselves on this point, we make one of the iron spoons red-hot, and place a little of the yellow mineral upon it. If it is pyrites the sulphur will burn with a blue flame, and giving off a characteristic sulphurous smell.

Gold is not altered, neither does it give off any smell, when thus heated. The specific gravity of the substance may now be taken by the methods described in Articles No. II. and No. X., in the Journals of May 13 and Aug. 6, when if it be gold its weight, as compared with an equal bulk of water, will probably be found to range from 18 to 19 times the weight of that fluid. Next take two watch-glasses, and place a small piece of the malleable metal in each. To one glass add a drop or two of nitric acid, to the other hydrochloric acid, and apply a gentle heat. If the metal in each case is unacted upon it fulfils another property belonging to gold—*i.e.*, its insolubility in an acid. If, on the other hand, it dissolves completely in either of the acids it is not gold. It may be copper; if so, the nitric solution will be green. Now, mix together in a test-tube one part of nitric with two parts of hydrochloric acid, the metal unacted upon by the acids singly when placed in the aqua regia dissolves completely. Apply heat until the excess of acid is given off, and afterwards dilute with rain water. A solution is thus produced to which we can apply the two special tests for gold.

Divide the supposed solution of gold between two test-tubes, into one pour a few drops of solution of the protosulphate of iron. If the surmise is a right one a brown cloud or precipitate will be thrown down, consisting of metallic gold in an extremely minute state of division. If this precipitate is dried in a watch-glass, and afterwards burnished, it will acquire the brilliant yellow lustre of polished gold. Into the second test-tube pour a few drops of the solution of protochloride of tin. If gold is present a purple precipitate, called the *purple of Cassius*, will be produced. A substance is used in the arts for communicating a splendid ruby colour to glass.

My next paper will treat of the use of the blowpipe, and of the detection of gold in auriferous substances through which the metal is disseminated, but in quantities too small to be visible to the naked eye; after which the metal silver and its ores will be discussed.

Mining Offices, Shrewsbury, May 31. EDWARD GLEDHILL.

MINING IN CARDIGANSHIRE.

SIR,—After visiting the different mines of the locality of and from Plynlimmon down the valley, I will make a few brief remarks upon their present workings and worth. PLYNLIMMON is now, without doubt, one of the first upon the list of rich lead mines in the county. As the agent's reports appear so often in the Journal, but little need be said by me of the different bargains, but the mine is now about 25 fms. deep. The adit level, which has been very productive almost from the beginning to the present end, has been proved to be in very valuable ground, as a 12 fm. level under the adit has been driven to within 10 or 12 fms. home to the adit end. The lode in the 12 fm. level is at the present time worth 3 tons of lead ore per fathom. The specimens on the floors and at the office are the best I have seen for years. There is also a deeper level (the 24), in which there is a very good lode for about 40 fms.—as far as it has been driven. The surface and underground machinery and other operations are going on as well as can possibly be expected, considering the shortness of water at the prevailing dry season. They are sampling 40 tons of silver-lead ore monthly, and this quantity may shortly be expected to increase—I hope it may, and continue for many years to come. The only difficulty of this and other neighbouring mines is the great scarcity of houses, lodgings being scarcely obtainable for the miners or the flooring-girls—consequently, higher wages must of necessity follow. It would pay the different companies to follow the example of Messrs. Taylor and Sons, who have commenced erecting some houses for their Esgair Lle workpeople.

SOUTH PLYNLIMMON, which is within one mile of the Plynlimmon, is being worked on parallel lodes. The engine-shaft is being sunk from the 20 another 10 fathoms. A level has been driven for a short distance in the 10 under adit, from which some beautiful lumps of lead ore have been broken, and may be seen on the floors and at the office. Meeting with a cross channel of ground on its western course, it for the time disordered the lode; but, by continuing the driving further on its western course, it will shortly resume its former appearance, and we hope

greatly improve, as it is going into the hill, and, consequently, greater backs. I would advise the company to sink their shaft deeper before they can at all expect to find any great riches, and to continue the western and stope the eastern levels, as the further driving of the level east would bring their end into daylight, being in the valley. The machinery on this mine is really good and nicely kept, and great praise is due to the agent for his untiring exertions. In the brook, a few fathoms west of the shaft, a lode is to be seen, a mixture of beautiful gossan, spar, copper, and lead ores; therefore, by continuing the sinking of the shaft for another 10 or 20 fms. deeper, and driving westward, I have no hesitation in saying I firmly believe it will in time overtake and equal its neighbour.

ESGAIR LLE.—I had not sufficient time to examine this mine, being late, and having to go some distance on to Ponterwyd; but, from what I gathered from parties there and what I saw, I was induced to believe that in its palmy days it never looked better than at present. I know for a certainty it never looked so clean and free from all obstructions; this, of course, is due to its representative, Capt. Williams.

Next in rotation, and immediately adjoining to the west, is the WEST ESGAIR LLE, over which I spent the best portion of two days. In the eastern part a cross-cut has been driven in the side of the hill about 50 fms., where the lode intersected is about 6 ft. wide, composed of copper and lead ores, gossan, and spar—in fact, one of the finest lodes I ever had the pleasure of witnessing. A shaft has been commenced to meet a rise coming up from the back of the adit level, and when communication has been obtained the further sinking under adit continued driving both east and west may be started at once in the adit, and very great and favourable results will be looked for by all who may be in any way connected with the mining interest of Cardiganshire. A beautiful water-wheel is being erected for this part of the mine alone. The heaps of stuff seen on surface brought out from the adit will give anyone an idea of the value of this lode, although as yet nothing has been done to the lode but going through it, as the air is rather dead to allow of more than the risemen working. For the work already done it reflects great credit and praise on the agent for his exertions and conduct throughout.

BRYN GLASS is the next on the western run of mines, and, although it has for the last year or two been idle, yet it is to be again worked, in addition to a large tract of land granted to Mr. James, of Aberystwith and London, by Colonel Powell. The great extent of land included in this sett is considered by mining gentlemen generally to be a very valuable property. We hope that this bold speculation may meet with every success.

Again, to the west of this land, and across the river, is a mine known as the GLAN CASTLE, which is being worked by Capt. Corbett. An adit level has been driven on the course of the lode for some distance, from which I have myself broken very good specimens of lead ore. Another lode has been discovered this last week, from which a bucketful of nice lumps of lead have been raised within 6 ft. of surface. I saw it yesterday with the owner, who is much pleased, as anyone may suppose. He will shortly, no doubt, seek a company. On leaving this mining sett we come directly into the Ponterwyd range of mines; but, as I have to take another journey up the hills next week, to visit the Nant-y-Moch and Dynas Mines, I shall then give your readers a more detailed description of those running from and including Ponterwyd down to the western extremity of Cardiganshire. SAMPSON TREVETHAN, M.C.E.

Aberystwith, May 27.

MINING IN WALES—ITS RETROSPECT AND PROSPECT.

SIR,—To touch the past of mining in the Principality is to contend with a historic difficulty of as rugged an aspect as it is possible to conceive. Well, it is certainly native to the position, being hewn, as it were, out of the peaks of Snowdon, and the ponderous, but less majestic, massiveness of Plynlimmon. It would be temerity itself to grapple with this subject, however prominently it presents points to hold on by, did I not trust to aid in reserve from those whose local knowledge, derived from sources written or traditional, may enable them to enter the array in your columns, and show effectively to the rescue. The silver and lead bearing districts of South Wales are traceable through scenery of the most beautiful description. In geographical character grand, varied, and romantic they stretch, taking them shorewise from Cardigan Bay southward to the centre of Carmarthenshire, investing Cardiganshire in silver mail, and then taking a more condensed type of argentiferous galena deposit course northward through Montgomeryshire, a county now bidding fair to rival the mineral fame of the most proved localities in the United Kingdom. In fine, it is, in familiar phraseology, bound to show that it still possesses sources of ore as deep, expansive, and magnificent as that which distinguished old Llangynog, and won it a place in the records of mine statistics to the amount of 6,000,000*l.* of profits.

Among the great mines of the Principality I may refer, in the first instance, to presenting good stepping ground to a still higher and more extended range as those eminently rich silver-lead undertakings, in what may styled, for the sake of definition, the Aberystwith district—Cwmsymlog, Goginan, Cwmsebon, Bwlch Consols, Darren, and others of rich and large producing notoriety. Thence making a preliminary *reconnoisance* before dealing with the operations and their products of several other mines of note, the eye is attracted by those "*Silver threads in the weft of price*," the tortuous courses of the rivers Dovey, Rheidol, Y-twith, and Teiffy, which arising in the high ground that stretches from Snowdon to Plynlimmon flow, for the most part, westward to the sea, and sections the country into districts, in some of which are to be found immemorial evidences of the mine industry of those good old folks, the forefathers of the people, whose works are their enduring monuments.

There southernmost lies the ancient Nant-y-Mwyn, in the neighbourhood of Llandovery, more than a century old, and of which it has been computed that the aggregate yield up to 1849 was 100,000 tons, in round numbers to the value of 1,000,000*l.* sterling; in that year its returns were close upon 2000 tons. Looking further still northward, and postponing for the present particulars of workings of great value, Esgair Mwyn comes into view; some 20 years ago the estimate of the yield here was over 600,000*l.* worth of ore, upon which the Earl of Powis took a royalty of 5*l.* per ton. Next come looming up Cwmystwith, Logylas, and Grogwinion, on the borders of the river Ystwith. Grogwinion and Cwmystwith have doubtless made returns at least to the amount of 1,250,000*l.*, while Logylas years past figured in the list of products at 250,000*l.*, and its then next neighbour, Frongoch, at 150,000*l.* Frongoch was then considered to be for its size the most ore-bearing and money-paying concern in the Principality. The old mines on the Rheidol comprise in this retrospect Esgair-Lle, Nantycria, Bodcol, Estymtean, Penrhiw, Rhewrhigus, Erwtome, Gwaithgoch, Gellerheirin, and Lyliwidol. The shadows of time rest in dense obscurity upon the early workings of most of those mines, but that extensive explorings, yielding considerable profits, occurred in Estymtean and Erwtome, under the Romans, is plainly evident. The yield of ore, at an ordinary calculation, must have been enormous. Permit me, for the time being, to stop at this stage of the task I have thus ventured upon, and I do so intending, with your permission, to return to it in your next week's Journal, my motive being that of embodying evidences of the ancient greatness and value of mining in Wales, of its present very promising progress, and of that great and prosperous future to which the known vast mineral wealth of that part of the United Kingdom must, by the inevitable gravitation of pysical facts and principles, ultimately attain.

85, Gracechurch-street, London. J. P. ENDEAN.

MINING ENTERPRISE IN IRELAND.

SIR,—The interesting articles which occasionally appear in the Journal are greatly appreciated in Ireland, and we should feel grateful to you for drawing the attention of capitalists to the great and inexhaustible resources of the country. The excursion season is now approaching, and one might combine pleasure and profit by making a run to the Green Isle. In the kingdom of Kerry the geological tourist will be delighted with the varied formation of strata he will find there, and its vast mineral resources which are yet undeveloped. Its copper mines, slate quarries, and very rich marbles. In the county of Tipperary, too, he can visit the silver mines, the coal mines of Sleevardagh, and the splendid slate quarries of Killaloe. The quarries have been lately taken up by a limited company, and they have already earned good dividends, which are yearly increasing, and are soon expected to be over 20 per cent. They are beautifully situated on the shores of Lough Derg, and are well worth a visit.

I hope you will continue your articles on Ireland's resources, and that they may induce capitalists to invest their money nearer home than in the doubtful ventures of far away climes. HIBERNIA.

Limerick, May 30.

[For remainder of Original Correspondence see to-day's Journal.]

MANUFACTURE OF SALT.—By the invention of Mr. J. B. BUCHANAN, New York, the purification of brine from sulphate of lime is effected by passing it through a vessel in which it is raised to a temperature of 3·10° Fahrenheit, and then filtering it to remove the precipitate produced. The chlorides of calcium and magnesium are removed by precipitation with carbonate of soda, or if they are superbundant they are concentrated and discharged. The largest possible evaporation is obtained by using high pressure steam generators for the first evaporation, and using the latent heat of this high pressure steam (as it is given off in condensation) to heat another boiler, and produce one equal quantity of steam of lower temperature and tension, from which again a third evaporation is being effected, and thus the process may be repeated between the highest and lowest boiling points of the brine as many as twenty or thirty times. This extreme repetition of effect is produced by raising the temperature of the first evaporation as high as it can be carried without danger to the apparatus (about 50.° Fahrenheit), and continuing the repetition or transfer of the same caloric from one boiler to another at short intervals, until the temperature is below the atmospheric boiling point.

PRINTING METALLIC SURFACES.—The invention of Messrs. LOWE and HARPER, Glasgow, consists in printing metallic surfaces direct from wood cuts, metallic blocks with the design engraved or cut thereon, or from electrotype blocks. This is effected by placing the block or blocks from which the design or designs are to be imparted to metallic surfaces, in an ordinary printing press, and passing through the press the metallic surface or surfaces, to which the design or designs are transferred by pressure. The wood cut, or other engraving, is charged with printing material of the requisite shade or colour, which is subsequently affixed to the metallic surface by a dyer or varnish, or by heat in a stove.

CUPOLA FURNACES.—Mr. P. NEWLAND takes a cupola furnace of the ordinary construction, and at a convenient distance above the sole of the furnace, and just below the tuyeres and boshes, he builds an arch of fire-brick, forming a kind of false bottom to the furnace. Above this arch or false bottom he builds up the sides with fire-clay or sand, so as to cause the false bottom to be dished or concave towards the centre; and at the centre he forms an opening through the same, for the molten metal and the flame to pass through. In the side of the furnace, in the space between the false bottom and the sole, the inventor leaves an opening, and from this he constructs a passage or flue leading again into the furnace above the boshes.

METALLIFEROUS DEPOSITS, AND UNDERGROUND TEMPERATURE—No. II.

The valuable nature of the information concerning India given in Mr. HENWOOD'S book* will have been ascertained from the notice published in last week's Journal. Continuing his account of Brazil, he remarks that at Ouro Preto Villa Rica particles of gold are thinly sprinkled through homogeneous soft blue clay-slate. Quartzose micaceo-talcose, which affords mere traces of gold, succeeds the clay-slate at Ouro Preto and Gongo Soco. A thin bed of calcareo-siliceous matter, flecked with micaceous iron ore and with talc, contains small quantities of gold at Cocaës and Gongo Soco. The itabirite (iron mica slate) and jacotinga conform to the micaceo-talcose slate, which they overlie, and maintain at the same time a certain coincidence with the contour of the surface; the self-same beds, therefore, take different directions and dips in various parts of their range. The itabirite consists in great measure of granular quartz and sundry iron ores; these, with smaller quantities of other substances, frequently occur either mixed or in alternate beds, but, especially in the central parts of the formation, granular, scaly, or crystalline iron-glance prevails; schistose structure is usually more pronounced amongst the alternations of iron ore and quartz than where the ingredients are more exclusively ferruginous, but even in these it exercises a marked influence on the productive character of the neighbourhood. The jacotinga partaking of the nature of the adjoining itabirite rocks consists in great measure of iron-glance, earthy black and brown iron ore, manganese, and talc; and, somewhat resembling them in structure, is slightly lamellar.

The principal members of the series, however, are certain conformable beds, which open at intervals to a width of some inches, and for several feet or even fathoms in length and depth; of these enlargements the central portions contain rough nuggets, flakes, and granules, sometimes isolated, but often united by intertwining threads of gold; towards the edges and sides of the bunches grains and particles become more and more thinly sprinkled, and the vein stones at length emerge in the ordinary jacotinga; sometimes several such short productive beds occur on identical parallels in the same formation; in all cases, however, the richest portions are the most highly inclined; the productive and the barren shoots of veinstone coincide in position both with the opposite undulated or rippled planes of cleavage in confronting portions of the hanging and foot walls, and with the several, kindly and uncongenial, strata where they interlie the joints of the country, and, at the same time, they all dip from the nearest bodies of granite. At Gongo Soco a mass of itabirite is both embedded in and penetrated by veins of auriferous jacotinga.

The gold of this formation is alloyed with silver at Agoa Quente, with copper at Durao, with palladium at Santa Ana and Itabira; all these substances, however, are alloyed with the gold of Gongo Soco, which is associated with less silver, but with more palladium and copper in deep than in shallow parts of the mine, and contains platina near the surface only. Short thin cross veins of quartz slightly displace some of the beds, but they soon merge in quartzose portions of the itabirite. A broad band, consisting of micaceous iron embedding crystals of oxydulated ore in some, but of carvoeira (siliceous sand), earthy talc, manganese, and earthy brown iron ore enclosing isolated masses of quartz in other parts of its range has afforded gold at Catta Preta. The canga, a breccia in certain but a conglemrate in different places, consists in a great measure of various iron ores now and then including fragments of quartz and of slate; at intervals it contains crystalline granules of gold, and in one spot at least it yielded auriferous native copper. Iron ores from the itabirite and jacotinga are largely smelted in many parts of the district. Joints in the itabirite of Gongo Soco emitted a sufficiency of pure air for the ventilation of a long drift.

The itabirite is succeeded by talcose rocks, mostly of schistose structure, which enclose bodies of siliceo-magnesian limestone; short, thin, and generally conformable beds of more or less granular quartz, largely charged with earthy brown iron ore; and broad bands of felspathic matter. The barren limestone of Gongo Soco is burnt for use, but at Antonio Pereira the rock is too silicious for the lime burner, and too slightly auriferous for the miner. The beds of ferruginous quartz at Descoberta, Cattas Altas, Fraga, Thesoureiro, and Antonio Pereira are seldom or never quite destitute of gold, and portions of them all have been wrought to advantage; frequently, also, the surrounding rocks are productive for considerable distances. The gold of this series is usually of great purity, but at Descoberta it is alloyed with tellurium. Crystals of topaz occur now and then in ferruginous talc-slate near Cattas Altas, and mixed on rare occasions with enclase, in unexampled abundance amongst the felspathic and talcose rocks of Capao and Boa Vista.

The detrital deposits of Minas Geraes are of different periods, and the gold contained in each of them may be traced to its parent formation. The older, coarser, and heavier detritus (cascalho), to the disruption and transport of which existing streams are inadequate, sometimes occurs above its present range. The greater amount of rain in wooded than in unwooded regions, and between streams and forests at their sources, was recognised in the earliest mining laws of Brazil. In spite of strict enactments, however, the auriferous districts of Minas Geraës are gradually denuded. Between Cattas Altas and Brumado, from Cäethé Cuiaba, and in many other places now destitute alike of wood and water, the roots of forest trees and the remains of water courses may yet be traced. In wet seasons quantities of debris are still dislodged by streams insufficient to cover them after the rains have ceased. The sandy and earthy portions of such matter, together with the refuse from mining works, continually find their way into rivers, whence they are gleaned and washed by feiscadores between seed time and harvest. Many of these muddy streams, however, abound with fish of various species.

Gold was obtained from Minas Geraes in 1599, but until 1695 it had not been discovered *in situ*. As early as 1618, however, laws were promulgated which regulated the disposal of mineral lands, but reserved to the Crown a proportion of their produce. During several years this royalty was nominally 20 per cent., but at different times various stipulated weights of gold, and divers rates of capitation tax on miners, were substituted. During a considerable period the impost on native miners was at a much lower rate than on foreigners, but at length all provincial duties were abolished. For a great while the amount of royalty paid by native miners exceeded 3935 lbs. troy a year, but before the abolition it had dwindled to 78 7 lbs. only. The entire produce of the province, from 1700 to 1860. is estimated to have exceeded 1,575,000 lbs. troy. For a long time neither a goldsmith nor a stranger was allowed to remain there; and, indeed, the same prohibition extended even to native Portuguese, as well clergy as laity, unless they were appointed to office by the Crown. In order to ensure the payment of royalty, it was declared illegal to remove gold which had not been converted into bars at the mint; and even then the license of a Government officer was necessary to protect it from forfeiture. This certificate that all legal imposts had been duly paid was required until the ultimate abolition of provincial duties.

Considerable interest will likewise be taken in the chapter devoted to Chili, which, although attracting less attention for the moment than Brazil, is nevertheless a country which has been, and no doubt will again be, a large field for British enterprise. Mr. Henwood states that the isolated mountain of Chanarcillo, which rises nearly 4000 feet above the Pacific, and more than 2000 feet above the surrounding country, consists of three calcareous, alternating with two felspathic, quartzose, and hornblendic strata. They all decline towards the south-west, but at somewhat different angles, and in various parts of the district they differ materially in thickness. Several beds in each of the strata are characterised by diversities of colour, composition, and structure. All five formations are traversed, but without displacement, by two narrow dykes of felspar, hornblende, and quartz. The entire series is intersected by many lodes and branches, of which the greater number bear 18° to 45° east of north and west of south; others, however, range nearly at right angles to them, but all, without exception, dip oppositely to the strata. The earthy ingredients of the lodes are much the same as those of immediately adjoining portions of the rocks, and their metallic contents undergo a corresponding change as they pass from one formation to the other.

Native silver abounds not only in many calcareous parts of most lodes but for considerable distances beyond their walls; it is disseminated through the Manto de Ossa, certain upper layers of the first limestone, and fills or faces their joints. Several of the ores of silver are disposed much in the same manner, yet, perhaps, scarcely to the same extent. But notwithstanding the lodes contain silver and several of its ores in the three limestones, their riches and the various ores they afford are by no means equally determined to every part of each stratum. Both the metallic minerals and the vein stones, however, maintain the same shoot in every lode, and in all the limestones; moreover, the richest parts of different lodes often occur on the same meridians. In the first limestone portions of the Candelaria lode afforded virgin metal and ore of various kinds, which yielded 900 lbs. troy of silver per avoirdupoise ton; and in the second limestone 1600 tons of ore from the Colorada lode gave 6400 lbs. of metal, one-eight of which was extracted by two miners in a month. A part of Waring's lode was so intertwined with native silver that, too tough for extraction with ordinary tools, and too porous to be blasted, it was cut out bit by bit with chisels.

Between the several calcareous strata the lodes, maintaining their normal directions and dips, partake of the felspathic, quartzose, and hornblendic characters of the strata which intervene, but they then afford traces of blende, and small quantities of iron pyrites only. Several unproductive cross veins which traverse the district differ materially from most yet nearly coincide with some of the lodes in direction, and, like the lodes in general, they dip oppositely to the strata, but in some measure conform to the shoot of the ore; their ingredients—calcareous in some, but felspathic, quartzose, and hornblendic in other pieces—closely resemble those of the immediately contiguous rocks; and they are divided lengthwise by numerous joints, of which the opposite faces are often deeply scored with unconformable striae.

But a portion only of the contents of the work with regard to Chanarcillo will be learned from the above sketch; but as the space at disposal is now exhausted the continuation of Mr. Henwood's account of the Chanarcillo district, as well as his description of Copiapo, must be reserved until next week, after which there will be some most valuable and interesting information to publish concerning the metalliferous deposits of Canada, North America, and Ireland. In the meantime, we would cordially recommend all who have the opportunity of doing so to read the book themselves.

* "Observations of Metalliferous Deposits." By WILLIAM JORY HENWOOD, F.R.S., F.G.S., &c. "Observations on Subterranean Temperature." By the same author (forming the Eighth Volume of the Transactions of the Royal Geological Society of Cornwall). Penzance: William Cornish, Green Market.

THE NEVADA LAND AND MINING COMPANY.

BY OTTOKAR HOFMANN.

The successful treatment of rebellious silver ores, as well as a conscientious and able business management, secured to the Auburn Mill, near Reno, Nevada, not only a good name, but also the well-merited confidence of customers; and it might be interesting to many of our readers to learn the method of manipulation of that mill, which is the property of the Nevada Land and Mining Company, with head-quarters at London, England. The present manager and superintendent is Mr. F. F. Osbiston, under whose skilful direction the good name and efficiency of the establishment will be still more promoted.

A favourable locality admitted the erection of suitable and practical reduction-works. There is a very capacious ore and sampling-house, a 20-stamp battery, 12 Varney's pans, 6 settlers, and in an adjoining department a boiler and retorting furnaces. All parts are so arranged, one above the other, as to avoid the handling of ore. On the left side of the battery there is a Stetefeldt roasting-furnace, with a feeding apparatus, taking the ore direct from the batteries. The cooling floor of the furnace is on the same level with the pans. The motive-power, taken from the Truckee river, is abundant, summer and winter, supplying an overshot wheel of 34 ft. in diameter and 24-ft. face.

SAMPLING THE ORE.—A very important question, requiring great care in a custom mill, is the sampling. In order to obtain a true result of the assay the small quantity of ore taken for this purpose must contain the same amount of precious metals proportionally as the mass from which it was taken. For this reason the sampli requires great precision, cleanliness, and order. A correct procee ing is troublesome and expensive, but indispensable in order to satisfy the customers and the mill management itself, and also to ascertain the real percentage of the value extracted. A neglect in this operation is generally followed by very disagreeable consequences. The first requirement for the purpose of sampling is the reduction of the mass to a uniform small size. It is not necessary to have the whole mass reduced to a fine pulp. This must be avoided for several reasons. It is an erroneous supposition that sampling before the battery during the crushing is the most proper way. It is incorrect for these reasons:—1. The sampling must be trusted to the workmen, as it requires from 6 to 48 hours or more, according to the amount of ore, before the whole lot is crushed up.—2. The ore is mixed with the necessary percentage of salt before crushing, in order to have it roasted in the Stetefeldt furnace. In making the assay this salt must be taken into account after the amount of its water has been ascertained. The same applies also to other chemicals or ingredients mixed with the ore on account of base metals. Although this rectification shows no special difficulty, it is sometimes, nevertheless, a source of mistakes.—3. If samples are taken at regular intervals, a somewhat uniform mixture and quality of ore is anticipated, which seldom exists in reality.—4. In case there is gold, native silver, or silver in the ore, a good deal of it will remain in the battery, causing a poorer sample. Besides this, the owner of the ore is bound to wait for the returns till all his ore is crushed and pulverised, while only a few hours are required to finish the sampling in a different and more reliable way.

At the Auburn Mill the sampling is performed in the same way as in Swansea and Andreasberg (Hartz) with rich ores. The ore is broken first to the size of a walnut, and spread out uniformly on a clean platform, in a flat square pile. Then four canals are made, crossing each other. From the ore obtained from these canals a smaller flat layer is formed, similar to the former. The canals must be made down to the floor, and nothing left therein. Each canal-stuff is then spread on the floor, covered uniformly with the ore of the next canal, and so on until all four are finished. From this a third heap is formed by canal-cutting, and the process is continued in this way until the pile is reduced in weight to about 100 lbs. This is crushed finer—to the size of a bean—spread again flat, and from 40 to 50 lbs. taken as before, and ground to a fine powder. It is then delivered to the assay office, provided with the proper label. This quantity by a similar operation in the assay office is reduced to about 1 lb.

ASSAYING THE ORE.—In order to ascertain the moisture in the ore, a certain quantity of the sample is dried in a porcelain dish above an alcohol lamp, on a sand bath, at a temperature not exceeding boiling heat, until a cold glass plate, kept above the sample, does not appear coated with precipitated vapor. Two weighings taken at short intervals must agree. The required temperature is easily observed and regulated, if the sample is continually stirred with the quicksilver end of thermometer, the temperature indicated being carefully observed. The loss of water is then proportionately subtracted from the ore, as the sample subjected to the assay is of the same dryness. One pound of the sample, for the purpose of assaying, is dried in an iron pan, above a slight charcoal fire, the temperature being regulated in the same way, by the use of the thermometer. The dry sample is then divided into two equal parts, one of which is given to the owner of the ore, the other kept in the office after the assay sample has been taken therefrom. From each sample two assays are made, the result of which must correspond exactly, otherwise a third or controlling assay is made. From ores containing less than $300 per ton, half an ounce is taken; from richer ore only one-fourth of an ounce, in order to avoid a larger loss of silver in cupellation. In case the shipper of the ore should get a higher yield of his duplicate sample, if assayed elsewhere, the reserve sample is then sent to one of the promiment assay offices of San Francisco to decide the question. Should there be a difference in favour of

the shipper it would be remitted to him. Such reclaims, however, are very seldom, have occurred only twice, and in each case the mill assay was correct. As soon as the value of the shipment is ascertained the due amount for the ore is paid up to the owner. The use of the Stetefeldt roasting furnace, free from royalty, the excellent water-power and other advantages, enable the establishment to offer the highest prices for ores of every description. The price tariff is published in most of the newspapers. The shipper is always invited to be present at the sampling of his ore.

Roasting the Ore.—The roasting of ore is performed in the Stetefeldt furnace, the best and simplest amongst all furnaces known. The description of this furnace has been given in the *Press* and other scientific journals. A detailed description of the furnace and the proceedings in roasting will be found also in Kustel's book on the "Roasting of Gold and Silver Ores." It is the most important advance that our young metallurgy of silver ores can show. The influence of the Stetefeldt furnace on mines of low grade ores will soon be apparent. The manipulation is simplified, the result improved, expenses reduced, and efficiency greatly increased. From 25 to 30 tons of ore, and more, can be roasted in 24 hours with one single furnace by the aid of six workmen, without skill or experience, to the best advantage, replacing 15 common reverberatory furnaces, employing about 90 men, who must understand roasting. The roasting itself in the Stetefeldt furnace is entirely independent of the workmen, whose principal business is to keep up a steady fire, attend to the feeding machinery, and draw the roasted ore out of the furnace.

Extent of Chlorination.—The roasting expenses are not over $4 per ton of ore; 87 to 95½ per cent. of the silver is transformed into a chloride, according to the character of the ore. Having the assay department in charge, I have had opportunity to inform myself of the result of roasting of different kinds of ores. Cupriferous silver ores give a better result in roasting than plumbiferous, as is the case also with the reverberatory furnaces; but while ores containing lead are difficult or even impossible to be treated advantageously in a reverberatory furnace, the Stetefeldt chloridises 87 per cent. of the silver, if there is 20 per cent. of lead in the ore. If less lead is present, the chlorination comes up to 91½ per cent. I have had no occasion to observe how ore would behave containing more lead than 20 per cent. If the amount of lead is too high, it happens that a partial clotting of the mass occurs while accumulating at the bottom of the furnace, which, however, can be avoided easily by adding to the ore some charcoal during the crushing. The charcoal acts only mechanically, preventing the immediate contact of ore particles. No lead is reduced thereby.

The chlorination of the silver I found to be 87 per cent. from very base ore, holding a high amount of lead; the highest with cupriferous ores was 95½ per cent. The average of all assays of this kind showed 91½ per cent. The greatest part of the chlorination is effected during the free fall of ore through the glowing chlorine-atmosphere. The finishing occurs while the stuff is lying at the bottom of the furnace. According to this, an arrangement for permanent drawing of the roasted ore would grow injurious. For the same reason, at the Auburn mill, the feeding is stopped during the discharge. At the moment the ore reaches the bottom, it shows from 19 to 27 per cent. less chloride of silver than if allowed to remain till about 1 ton or so is accumulated. Of cupriferous ores I found that, if the ore assayed 12 per cent. in copper, 22 per cent. of it volatilised into the condensing chambers, 10 per cent. remained in the ore as a chloride and subchloride, and the balance turned into an oxide. Of ores containing lead, I found from 20 to 60 per cent. less lead in the ore after roasting. For this reason the bullion from base ores is seldom below 600 fine. The roasted ore is changed, as usually, about 800 lbs. at a time, and amalgamated for six hours. The amalgam is retorted, and the bullion assayed in the wet way, after Guy-Lussac's method.—*Scientific Press* (San Francisco).

THE DEEPEST COLLIERY IN AMERICA.

The occurrence of a fire in the Hickory shaft, at St. Clair, Schuylkill county, Pennsylvania, attracted more than usual attention among those connected with coal mining in the district, owing to the circumstance of the Hickory Coal Company's workings being the most extensive yet prosecuted on the American continent. The slope workings of the Mammoth vein have now reached a depth of 400 yards, at an angle of 19½° south. The main gangway westward is 9000 ft. long, commanding an area of 130 acres of coal, with an average thickness of 30 ft. Two pumping engines are used, one lifting the water 200 yards into a sump, and the other from this to the surface. The width of coal from the gangway to the surface increases as the bed crops higher up the mountain going westward, and at the highest point is 1800 ft. wide, where the main airway to the mine is driven through to the surface, and by which the mine is ventilated by an exhaust fan of 12 ft. diameter, driven by a steam-engine of 25-horse power, at the rate of 200 revolutions per minute. Overlying the Mammoth vein is another, known as the Seven Foot, but really averaging 10 feet thick. On the Mammoth vein, 300 yards west of the foot of the slope, a tunnel is driven southward into the Seven Foot vein, and a gangway in it parallel with the gangway in the Mammoth. From these gangways, which are outlets for coal cars, the coal in the two veins is mined.

With regard to the ventilation of the mine, the *Iron Age*, whence this description of the mine is taken, explains that the air is brought down the slope through the main gangway until it reaches the tunnel to the Seven-Foot vein, just within which the air is split, half going through the tunnel, and half to the workings of the Mammoth bed. Near to the west end of the mine these two currents are again united, and thence drawn by the fan to the surface. A large amount of coal is left unworked to support the roof of the mine, give access to and work it; but with a thickness of 25 ft. in one and 10 ft. in the other, the yield of coal is enormous. From 1848 to 1866 the colliery has yielded 1,606,955 tons; the loss of coal has been almost equal to one-half, and cannot be recovered. The Hickory shaft is 666 ft. deep to the Mammoth vein, and secures a large body of coal at a reasonable depth, already partially opened by the slope. As to the geological structure of the region the location is highly important. On the long slope of the great Mine Hill anticlinal axis, it enables entrance to the Mammoth vein at a practicable depth, and a working length only limited by land boundaries on leases. This shaft commands coal to the extent of 8,704,350 tons. Of this immense quantity the two furthest removed is only 1350 yards from the foot of the shaft, passing over a self-acting plane of 470 yards in length, leaving a haul of only 880 yards, a matter of prime importance in the cheap production of coal.

The sinking of the shaft was commenced Sept. 7, 1864, by making an excavation 30 ft. by 22 ft., and 40 ft. deep to the first stratum of solid rock. This was used as a foundation for a wall 4 ft. thick and 22 ft. by 14 ft. in the clear, which was carried up to the surface, and of this size the shaft was sunk. Frequent delays occurred from weather and strikes, but in two years and six days the Mammoth vein was cut. Deducting time lost 428 days were spent in sinking 623 ft., giving 1·45 ft. per day. The shaft is divided into three compartments of 6 by 12 ft., by 22-in. timber, placed 4 ft. apart from top to bottom. The surface water is caught by drains cut around the shaft, and by them conducted to the sump in the Primrose vein, whence it is hoisted 320 ft. by an 8-in. pump to the surface. Below the Primrose there is so little water that a pump is not necessary. During the sinking of the shaft no artificial ventilation was used, nor is there now. Ordinarily in sinking a well 60 ft. deep ventilation is difficult, but here a simple contrivance and a partition in the shaft so creates a draught that pure air is abundant everywhere through the workings. During the sinking of the shaft 10 seams of coal of the aggregate thickness of 76 ft. were passed through:—

	Depth.	Thick.		Depth.	Thick.
1—Coal	40 ft.	1 ft.	6—Holmes	402 ft.	4 ft.
2—Coal	94	4	7—Rough Vein	490	4
3—Orchard	115	6	8—Four Foot	627	6
4—Coal	313	1	9—Seven-Foot	639	10
5—Primrose	320	10	10—Mammoth	669	30

The object of the sinking was to develope the Mammoth and Seven-Foot veins, together 40 ft. thick, and all the most productive and reliable beds of the anthracite region; and to show the importance of the undertaking, a comparison of the English mines with the Pennsylvania anthracite mines in the four years ending 1866 is given:—

	English tons.	Pennsylvania tons.
1863	88,292,515	9,631,101
1864	92,789,873	10,184,320
1865	98,150,587	9,652,391
1866	101,630,543	12,703,883

As regards coal areas, it is shown that although the aggregate extent of the coal deposits of the United States is immensely greater than in Great Britain, the area of the Pennsylvania anthracite deposit is comparatively small. Thus, there is of bituminous coal in Great Britain 8139 square miles; in British America, 18,000 square miles; and in the United States, 133,132 square miles; whilst of anthracite Pennsylvania has but 470 square miles, and Great Britain 3720 square miles, hence the importance in Pennsylvania of easy and cheap development and production.

DRILLING ROCK BY MACHINERY.

THE BURLEIGH AND THE DIAMOND DRILLS.

A correspondent, writing from the Nesquehoning Tunnel, Pennsylvania, to the Pottsville *Mining Journal*, says—"A letter from a correspondent at Port Carbon, on the comparative merits of the Diamond and Burleigh Drills, is calculated to give such an erroneous opinion of the latter that I beg permission to say a few words in reply. It is to be regretted that the writer deals only in general assertions as to the relative merits of the two machines, the only just test in such cases being their actual practical operation. The Burleigh drill was introduced in this tunnel at its start, March, 1870, and until this time has been in continuous operation, having driven at one end 1350 feet of heading, 17 by 9 feet, through the hardest conglomerate, and 1720 feet of enlargement through the coal measures and conglomerate; the result of its working has been exceedingly satisfactory. I have yet to learn that the Diamond drill, under any circumstances, has ever done anything like this amount of work; indeed, I believe it is not on record that it has ever done any successful work of any amount, except prospecting at great expense, where its pre-eminence is acknowledged. Certainly wherever it has come into competition with the Burleigh drill it has failed, the last instance on record being on the U.S. Government work in New York Harbour, where, after a series of expensive experiments, it was abandoned, and the Burleigh drill substituted.

Your correspondent gives the number of drills in the shop to one at work at Mont Cenis Tunnel; and although he admits that the figures may not be true of the Burleigh drill, rather leaves the reader to infer that they may be. The actual experience at this work is, that with 18 drills on the work, all told, 11 can be kept constantly running in the tunnel with a force of four machinists.

A single machine has been known to drill 4000 lineal feet of hole without any repairs; and I apprehend that when an attempt is made to work a like number of the Diamond drills, with their necessary rotary engines, there will not be any saving over these figures.

In the hardest conglomerate we find no difficulty in putting down a hole 2½ feet deep, and in sandstone and slate 4 to 6 feet, with a single point. One blacksmith and helper keep all the points used in this work sharpened, and the wear in steel is very slight. Perhaps your correspondent would make a comparison of the expense of these two men and the waste of steel on the one side, and the wear and breakage of his expensive diamond bits on the other.

As regards the rapidity with which the Burleigh drill will advance a hole, your correspondent appears to be misinformed. The experience of this work since its start is, that in the conglomerate a machine will drill 10 to 12 ft. of hole per hour in the actual every day work, and in sandstone from 20 to 25, and in some cases these figures have been greatly exceeded. We have nothing approaching any experience to determine what the Diamond drill may be able to do under like circumstances for a similar length of time. In regard to the heavy carriages which are necessary to hold the Burleigh drill in its place, it is likely if the Diamond drill is ever put into a large tunnel heading the same or more elaborate contrivances will have to be arranged to keep it in position.

Our universal mode of working is to drill a set of holes, and charge them ready for the electric discharge, while the debris of the former blast is being cleared away, thus proving that this "convenience is available" in some other than the Diamond drill; indeed, the only difficulty is that we cannot get the debris away as fast as the sets of holes can be drilled and loaded. The holes of the Burleigh drill are perfectly round, and are charged with cartridges, not with loose powder. The great and growing interest in this question of drilling rock by machinery, and in hopes of doing justice to the first and only really practical machine drill ever put into operation, must be my excuse for thus troubling you.

FOREIGN MINING AND METALLURGY.

Portugal contains several coal mines—those of Pedro da Cova, Busaco, and Moinha da Covene; but the working of these collieries not having been attended with profitable results has been frequently interrupted. The mines of San Pedro da Cova only date from 1802; they supply Oporto with the coal required for steamers, and belong to a French company. They are the only Portuguese coal mines which are worked at a profit. The Belmez Collieries, in Spain, have acquired a rather considerable importance of late, as Belmez coal now competes advantageously with English coal at certain parts of Spain. Belmez coal is of excellent quality, and the direction of the Northern of Spain Railway has recently made arrangements for receiving considerable supplies of it. The Belmez workings are 150 miles from Badajoz, and 326 miles from Lisbon. A railway has been constructed to unite Belmez to the Spanish network of lines. This line, which has been for some time open for traffic, meets at Almorchon the railway from Madrid to Lisbon. Belmez coal is delivered to the Northern of Spain Railway at 12s. per ton, plus 9s. 6d. per ton for expenses. This price is a little higher than that of English and Belgian coal, but with a reduction in railway rates Belmez coal would acquire considerable outlets even in Portugal.

Now that the Parisian insurrection has been suppressed for good and all, and now that tranquillity appears likely to be re-established in France the position of the Belgian coal trade may be regarded as much improved. Industry is expected to revive generally, with an activity rendered all the greater by the fact that its energies have long been repressed. Already orders are arriving freely at the various industrial centres, and most of the lines of railway being opened, the only question which will pre-occupy industrials will now be that of means of transport. If these do not make default to too great an extent, a profitable season may be anticipated, which would compensate coalowners for the losses which they have had to sustain during ten months of idleness. Complaints already begin to be heard in the Charleroi basin and in that of the Centre as to insufficiency of rolling stock; but, perhaps, these complaints are not entirely justified, and a great outcry is possibly made in order that something may be obtained. A ministerial decree suspending navigation for a period of forty-two days on the Charleroi and Brussels canal has caused a general feeling of discontent, although the suspension is enforced for the execution of certain necessary repairs. The Bochum Mining Company is paying a dividend for 1870 at the rate of 6 per cent. per annum. The Silesian Zinc Mines and Foundries Company is paying a dividend for 1870 at the rate of 4½ per cent. per annum. The Guehlitz and Vahrnow Lignite Company has been paying a dividend for 1870 at the rate of 2¾ per cent. per annum.

The general condition of the Belgian iron trade continues satisfactory. The Vieille Sambre Rolling Mill, at Chatelet, will soon be brought into activity; the approval is only awaited by the statutes of a company, which will carry on the works. The annual report of the Liége and Limbourg Railway Company states that its rolling stock has been considerably extended during the past year. The directors express an opinion that the Liége basin contains further valuable elements of traffic; several new junctions with collieries and industrial establishments are either projected or are in course of construction.

The last advices from Havre indicate the sale of about 100 tons of disposable current marks, at 67l. 10s. to 68l. per ton, Paris conditions. At Marseilles there has been no variation in prices. In Germany transactions in copper have not displayed much animation; nevertheless, at some points a slight improvement in business has been remarked. At Berlin especially prices have slightly advanced. The Rotterdam copper market has presented no variation. There is little to report with regard to the French tin markets; at Havre the article completely makes default. Upon the German tin markets the state of affairs is not very favourable. At Berlin, for example, prices have slightly given way. At Rotterdam considerable transactions have taken place in Banca at 76 fls.; the market has been firm at that price. Billiton has been held at 75½ fls. At Havre, Spanish lead, first fusion, has been dealt in at 18l. 16s. per ton. At Marseilles lead in saumons, first fusion, has brought 17l. 16s. per ton; ditto, second fusion, 17l. 8s. per ton; lead in shot, 20l. 8s. per ton; and rolled and in pipes, 20l. per ton. At Berlin the demand for lead has been more active. At Rotterdam there has been no change to notice. Stolberg and Eschweiler have brought 11 fls.; and German lead of various marks, 10¾ fls. There is but little stock of zinc at Havre; at Marseilles quotations have remained the same. At Breslau and Hamburg the state of affairs has not changed; the article remains neglected.

FOREIGN MINES.

St. John del Rey.—The directors have received the following report, dated Morro Velho, April 29:—Morro Velho produce, second division of April, 12 days, 3339 oitavas, yield 2·003 oitavas per ton. Sinking in new shafts—A (15 days only), 3 fms. 1 ft., putting in pumps first 15 days; B (30 days), 5 fms. 1 ft. 10 in.

Don Pedro.—F. S. Symons, April 29: Produce: Weighed to date, 3785 oits.; estimate for month, 5085 oits.—Mine: Operations proceeding favourably. No box-work, and but average strake work from lodes at Alice's west. Bottom of mine still in abeyance. Cross-cut from Vivian's progressing, and auriferous samples taken from end, showing that we are already in contact with the lines that generally make below auriferous jacotinga lodes. Laying of tramroad in Treloar's—that is, the adit level—approaches completion, and the driving of the middle adit has been resumed. Nothing new in exploratory works at Tambor and Mato das Cobras.

Anglo-Brazilian.—F. S. Symons, April 29: The separation in Fundao stone is being carefully carried on; as yet the samples have not been rich. The Victoria stamps have been idle nearly the whole of the month, for repairs, which are now, I may say, completed, and the stamps in first-rate working order. The large amount of stone accumulated during stoppage will be treated next month. Attendance of force has been equal to requirements, and the health of the establishment favourable.—Pitangue: The shallow adit is being pushed on day and night. Repairs to buildings are progressing in a satisfactory manner.

General Brazilian.—Thomas Treloar, April 28: The wet season is over, and our operations generally are progressing rapidly at all places but one. The points flooded by heavy rains have been resumed, and at the next wet season I hope our adits will exempt the mine from similar impediments. The shallow adit at St. Anna is still very troublesome, so advancement here is very slow. At the old adit we have not yet reached the bottom of the Fundaos. They are deeper than expected, and, though wet, the water hitherto has not been a serious inconvenience in clearing them. We are anxious to sample the bottom in order to ascertain the value of the shoots; but working on them for extraction of gold will not be commenced before they are reached from Haymen's shaft and the stamping-mill ready. Debris auriferous, but not rich. The stamping-mill is advancing apace, and another has been commenced at Itabira, close to Moore's shaft. In all we are mining at fourteen points, eight of which are for opening the old mines of St. Anna and Itabira, and six for exploring the new ground intervening.

Rossa Grande.—No letters have been received by this mail as yet.

Taquaril (Gold).—T. S. Treloar, April 28: The features of the mine since last commented on have presented no change calling for remark. The workings at Pinga d'Agua are being cleared out, and a few samples showing gold have been obtained from the crushed matter. From the shoot in under the lode a little box-work is still being derived. The exploratory operations are progressing, but no discovery has been made.

Frontino and Bolivia.—The directors have received from Mr. Rouch advices under date of April 12, accompanied by a remittance of 246¾ ozs. of gold dust, the produce for the month ending March 20. The same mail has also brought the missing accounts from the mines for the month ending Feb. 20. The following is the account and produce for the month ending March 20:—Cost: At Frontino and Bolivia Mines, and expenses in London and Medellin, 990l. 15s.; depreciation in plant, at 10l. per cent. per annum, 70l. 11s. 8d.—Produce: 246¾ ozs. of gold dust per 1340 tons of mineral, average yield per ton, 3 dwts. 16 grs., 555l. 13s. 4d.—Loss: 435l. 1s. 8d. The gold produced during the month ending Feb. 20 was 263½ ozs., valued at 634l. 10s., and the cost for that month amounts to 1017l. 11s. 8d. The falling off in the produce of gold for the months of February and March, at the Bolivia Mines, was caused solely by the stoppage of the stamping-mills, in order to effect the alterations and improvements which Mr. Rouch thought it necessary to make in the works there, and which are referred to in the directors' monthly circular of the 3d inst. Mr. Rouch reports, under date of April 12 last, that he had just returned from the Bolivia Mines, after an exceedingly busy and anxious time.

United Mexican.—Extracts of despatch from Mr. Hay, dated Guanaxuato, April 21:—Mine of Jesus Maria y Jose: The work in this mine goes on the same as heretofore. The sale on April 5 was $2278, on the 13th $1407, and on the 20th $2699.—Mine of Remedios: In this mine the extraction has been very much the same as the previous month, the ley of the ore continuing to be rather low. The sale on April 5 was $1080, on the 13th $599, and on the 20th $896. The monthly operations show a profit of $79, the company's share being $46. A small rasper came in from Duran on April 1, but is not included in the above statement.—New Concern: Adit of San Cayetano, and Mine of Buenos Ayres: In the adit of San Cayetano, ground of Buenos Ayres, we have driven during the five weeks of March 13½ varas, without any change in the appearance of the rock.—Mine of San Antonio de la Ovejera: In the last month we drove 8½ metres. The cross-cut is now 65 metres in the mountain, having advanced 3½ metres in the two weeks of the present month.

Eclipse (Gold).—Mr. Henry Tregellas, May 2: Our operations at the mine have progressed satisfactorily. Haymen's shaft has been sunk 100 ft. below the 220, and we have commenced driving north at 300 ft. from surface, or 86 ft. below the 220, giving us 80 ft. of backs, which I feel assured is the best piece of ground in the mine. We have holed to the winze in the 160 from the rise in the 220. We have also got into the lode again in the 160, which had been hove by a little cross-course, and are now driving north on the same, lode 6 ft. wide, and I am glad to say a good lode. All we want is proper stamping mill, when I believe the Eclipse Mine will be one of the best gold and silver mines in this or any other country. Rest assured that all is being done that can be done; and but for the sickness of two of our carpenters we should be further ahead with our crushings.——Telegram from Mr. Henry Tregellas, Nevada:—"Atmospheric Mill constantly breaking down bottom tunnel, rich for gold."

Wyoming Sweetwater.—The agent at South Pass reports that the title deeds of the property have been recorded, and operations at the mine commenced.

Braganza (Gold).—Capt. Roberts, Morro Tabac, April 28: Since my last report, I am pleased to say, the new stamps has continued to work regularly day and night, with a full supply of water, and got through a quantity of stuff. We are obliged to make our washhouse on a larger scale, to meet the increase of work done, and hope to have it completed before the next mail.

Battle Mountain.—Capt. Richards, May 11: Virgin: Hallow's shaft is being sunk below the 113 ft. level, and a plat is being cut at the same time. The 113 ft. level is being driven north of Roach's winze for proof of the lode and increasing ventilation when it shall have been holed with Moore's winze, now down from the 73, deep enough for the purpose. The lode in the stopes in the back of the 113 ft. level contains some rich ore. The 73 ft. level north is being forced on night and day with all speed, and the lode has turned out some splendid rocks of the richest kind of ore during the past week. The stopes in the back of this level (Jack's stopes) are producing a fair quantity of ore.—Lake Superior: Nothing of importance has occurred in Price's shaft since the specimens of native copper met with, and noticed in my report of April 27 last. In the 70 ft. level south the lode is of an exceedingly promising character, and produces a little ore occasionally; going towards the junction of this with the Virgin lode it should make an abundance of ore by-and-bye. Ore raised 450 sacks.

Anglo-Argentine.—Captain Joseph Vivian reports for March—After many unavoidable delays, I have the pleasure of informing you of the starting of the engine on the 20th inst. The masons are now busily engaged preparing stone for foundation of stamps, the building of which will be commenced in the course of eight or ten days. This work will be pushed on with all possible dispatch, in order that the buildings required for the reception of the amalgamating machinery may have our sole attention. We are getting on rapidly with the driving of adit cross-cut east, towards old workings, which we hope to reach in about five weeks, when we shall be in a position to send a large quantity of highly auriferous ore to stamp at a comparatively small cost. The reduction officer reports—I have examined on the batea samples of virgin mineral from the lode at the north mine, and of the desmontes from the same locality. The former shows very rich in gold, containing, I should say, 2 to 2½ oz. per ton. Much of the gold is very fine, but still a considerable portion of that from these samples might also be called coarse, and can, therefore, be easily separated. The desmontes also show gold in the batea, though of course they are much less rich than the virgin ore; they may be put down as worth probably ½ oz. per ton. I find they contain, besides the gold, sesqui-oxide of iron (which seems to constitute the greater part of their bulk), galena, pyrites, and brown sand. The gold from both kinds of ore is rich in colour.

Eberhardt and Aurora.—The directors have received 16 bars of silver per Calabria, valued at 3800l., being the produce of about three weeks' run from the company's small 10-stamp mill, called the "Oasis."

Glasgow and Cape Breton (Nova Scotia).—The directors have advices under date May 15 from their general manager at Sydney (N. S.), informing them that the contractors of the railway had broken ground that day. The agent is in possession of the reserve coal field, and road-making, building of miners' houses, &c., are being pushed on rapidly. The engineers have much improved the course of the line, and a saving will thereby be effected.

[For remainder of Foreign Mines see to day's Journal.]

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